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THE AWAKENING IN ENGLAND.

A commission was recently appointed to inquire into the existing system of ventilation in the tunnels of the Metropolitan Railway, better known as the London Underground, and recommend some measures for the palliation of the unbearable nuisances of smoke and gases with which these foul subways are deluged by the coal-burning locomotives used in them. The report of the commission is unique in the history of British Board of Trade committees, since it goes directly to the root of the matter and cuts the gordian knot of the difficulties surrounding the case with a recommendation for the use of electric traction and the entire suppression of the locomotive. While it is true that the suggestion is obvious, it should be remembered that it emanates from an exceedingly conservative commission, and refers to a system which has become a traditional part of the life of London. Such a suggestion, under the circumstances, means that the advantages of electric traction have deeply impressed themselves upon English engineers.

The growing interest in electric traction in England is manifesting itself also in the rapid construction of urban trolley systems there. It cannot be very long before the vast convenience of this means of transit will overcome the conservatism of the residents in English cities, and, this once done, probably work there the same revolution in the conditions of city life that it has in this country. The Liverpool elevated railway and the electrically operated underground system now in use in London are admirable examples of the ability of English engineers to cope with the difficulties of heavy electric traction, while the network of railways through the midland region, with their frequent towns and dense tributary population, presents perhaps the best opportunity existing for the successful application of electricity to trunk-line passenger service.

These English main-line railways are probably the finest in the world in their permanent equipment. Running on private rights of way with no grade crossings, built with immense solidity, avoiding curves and grades by a lavish expense for tunnels, viaducts and cuttings, they may be regarded as the ideal field for the development of heavy electric traction. With a class of travelers already accustomed to lighter types of cars than those in vogue in America, a system of ticket-taking lending itself readily to the rapid handling of passengers at way stations, a density of population the like of which exists nowhere else, all that is needed is the rapid acceleration possible with electric motors for the inauguration of a suburban service near London incomparably the best in the world.

The English are slow to adopt innovations, but they are persistent in carrying out progressive ideas. When the electrification of their railway systems is begun it will be well and thoroughly carried out. It seems that a railway situation there presents too good an opportunity now to make longer delay advisable, and it is to be greatly hoped that the interest in electric traction today so marked in Great Britain will not confine itself to street railways alone, but will influence as well the immediate equipment of the interurban systems.

ELECTRIC HAULAGE FOR CANALS.

The problem of electric haulage for canal service has received no little attention during the past few years, and a number of diverse methods have been fully exploited for this purpose. So far the majority of attempts seems to have divided themselves into three classes—the application of a motor on the canal boat to a propeller, the operation of a towing apparatus suspended on cables over the towpath, and the use of a hauling machine operated by a trolley, which fulfills the purpose of a horse moving along the towpath and towing the boat after it. This latter idea has recently received considerable attention in Belgium and France, while experimenters with the other methods seem to have chosen the Erie Canal as their theatre of operations. There seems to be a serious difficulty connected with the use of any form of screw propeller for canal-boat propulsion, due to the fact that the wave created by screw-driven boats is exceedingly destructive to the banks of the canal, unless these are made with concrete or cemented masonry walls, which is not often the case. The "slip" of the screw, at these low speeds, reduces the efficiency of propeller systems. For these reasons it has seemed necessary to adopt some form of haulage towing, the conditions practically requiring that the horse or mule now employed be replaced by some form of automobile mechanism pulling the tow rope.

In a paper read a few nights ago before the American Institute, Mr. Richard Lamb set forth the haulage system which he has developed for canal purposes. In brief, this consists of a suspended motor mechanism turning a drum, around which four or five bights of a loose cable, running under the trolley or supporting cable upon which the apparatus moves, are taken. This machine receives its current from the two cables, and works itself forward or backward, towing the boat after it. It is said to operate with satisfaction. The question naturally arises whether there is any necessity for departing from ordinary and well-known methods, and building the elaborate structure of cables upon which this suspended motor is operated. There is no reason why a simple truck moving on a track on the towpath would not answer every purpose, expose its operators to far less danger, be infinitely more manageable at all times, and be useful, perhaps, for other purposes as well as for towing. When it is considered that the "draw-bar pull" required to haul the ordinary canal boat is comfortably and satisfactorily furnished by one horse, it will be seen that the truck for this purpose need not be very large, very heavy, or equipped with very powerful motors. The speeds are necessarily slow, in general about 3 miles an hour, and a machine for this purpose could be designed with such perfect ease and its performance predicted with such accuracy that it seems hardly necessary to undertake the elaborate construction proposed by Mr. Lamb and other experimenters along this line. The solution of the problem that is already at hand is perfectly simple and obvious.

AN AUSTRALIAN ELECTRICAL EXHIBITION.

The very creditable electrical and engineering exhibition recently held in Sydney, Australia, is described and illustrated on another page of this issue. A lesson is to be learned by American manufacturers from the prevalence of German and English exhibits there shown, and the rather meagre display of machinery manufactured in the United States. Australia is a great and growing market for engineering supplies and manufactures. A country blessed with many natural advantages and having much native wealth as yet undeveloped, it is settled by a vigorous and progressive class, speaking our language and ready to trade with us if we can successfully compete with German and English manufacturers. It is as natural a market for American products as Canada, albeit further off, but it seems to have been somewhat neglected by American manufacturers. The pre-eminence of this country in electrical manufactures is a good basis to begin upon. Certainly we should not be outstripped in the markets of Australia by German makers, and it is well worth the while of any American manufacturer to exploit his goods in them, since the result of competition with either English or German articles seems to be a foregone conclusion in his favor.

ELECTRICAL INSTRUCTION IN A REFORM SCHOOL

It has been urged in these columns at various times that a crying necessity for practical instruction in electrical handicraft exists, and that there is need of schools for the equipment of young men as electrical artisans. The manual work of the electric arts differs from that of the older mechanical trades in that it requires considerably more intelligence and further insight by the workman into the results of given combinations. It is a fact somewhat to be regretted that so few schools have attempted to turn out electrical mechanics—men ready to undertake the actual work of electrical construction, with hands trained to the performance of the skillful labor required and sufficient elementary knowledge to keep them from making serious mistakes. It is much to the credit of the New York State Industrial School, at Rochester, that it should have undertaken to transform some of the rather refractory types of boys committed to its care into skilled electrical artisans.

On another page Mr. Joseph T. Freeman tells how the work is progressing, and illustrates the appliances at hand for instruction. That such remarkably successful results have been accomplished is distinctly an achievement, and one upon which not only the faculty of the school, but society in general, is to be greatly congratulated.

CONCERNING PROMPTNESS.

There are a few subjects upon which it is proper for a journal to indulge in self-praise to a certain degree, and one of these is the promptness with which it serves its readers with accounts of interesting and important events. The Electrical World feels that it has just reason to be proud of its fine Street Railway Convention report number (the issue of last week), not only on account of the excellence and fullness of the report of the convention, and the descriptions and illustrations of exhibits contained in it, but especially because of the fact that it appeared four days in advance of any of its Eastern contemporaries, thus giving the first complete and fully illustrated account of the Street Railway Association's meeting. That the issue contained nearly twice the usual number of reading pages, as well as a largely increased number of advertisements, did not delay its appearance an hour beyond the usual time. It was in the hands of its readers in New York early on the morning of Saturday, October 23—within less than twenty-four hours of the adjournment of the convention.

Meeting of the American Institute of Electrical Engineers.

The one hundred and nineteenth meeting of the American Institute of Electrical Engineers was held on Wednesday evening, October 27, the paper of the evening being entitled, "The Development of Electric Cable-Ways." The paper was read by its author, Mr. Richard Lamb, of New York City, and was illustrated with a number of interesting lantern slides, showing the development of the Lamb cable-way for logging in swamps and canal haulage. The paper was of a practical character, and highly interesting in displaying a new method of adapting electricity to certain rough and heavy work with probable great economy. The discussion which followed the paper was long, and confined itself to non-essential points of efficiency of the apparatus and the motors employed. It was participated in by Messrs. Steinmetz, Wolcott, Sachs, Martin, Keith, Kennelly and others.

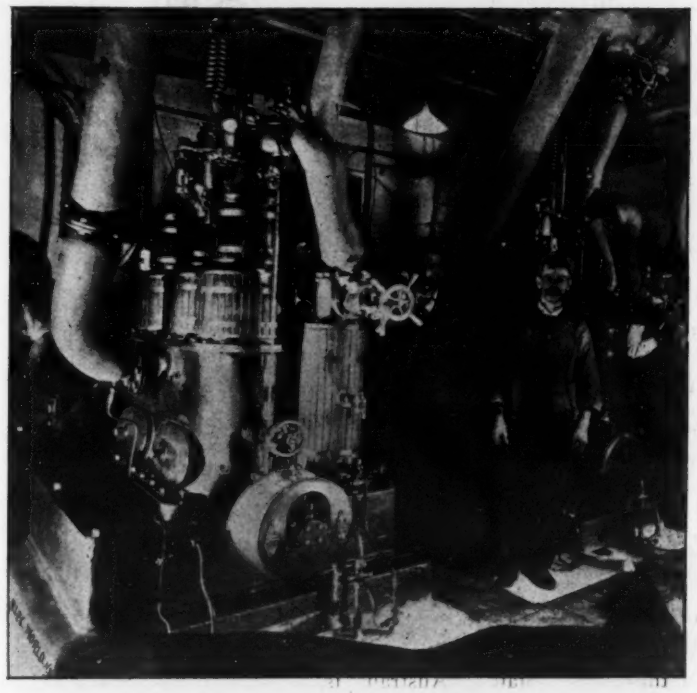
GENERAL VIEW OF ENGINEERING AND ELECTRICAL EXPOSITION, SYDNEY, AUSTRALIA.

An Electrical Exhibition in Sydney, New South Wales.

On the 26th of June last an exhibition of engineering appliances, machinery and scientific apparatus was opened in Sydney. The exhibition lasted three months, its object being the advancement of science and the promotion of a general and practical education. The exhibits were non-competitive. Among other exhibits were those of steam, gas, electric, hydraulic and hot air prime movers, railway, tramway and vehicular appliances, electric generators, conductors, testing and measuring apparatus, telegraph and telephone apparatus, lighting machinery, etc. The management appointed Mr. Edward Noyes, of Sydney, its representative to foreign lands. This gentleman visited Europe and America, and succeeded in obtaining many exhibits.

The fair was located in Prince Albert Park, a very desirable place in Sydney, close to the single railroad terminal. One part of the main building is shown in the illustration. Among the prominent electrical exhibitors were, of course, the great firms of England and America, Siemens Brothers, the Brush Electric Company, the General Electric Company, and the Edison-Swan Electric Light Company. The exhibit of the last-named company may be seen in the illustration. Two views are given also of a typical Australian isolated plant, supplying current for light and power purposes. The engines are three-crank vertical tandem compound of the Willans type, direct-connected to two-pole dynamos. Among the exhibits was the General Electric switchboard to be used on the new electric street railway lines in Sydney. This new system will be operated by the New South Wales Government, as are all tramways in the province. A representative of the Government, Mr. H. H. Kingsbury, is now in America to obtain apparatus and equipment.

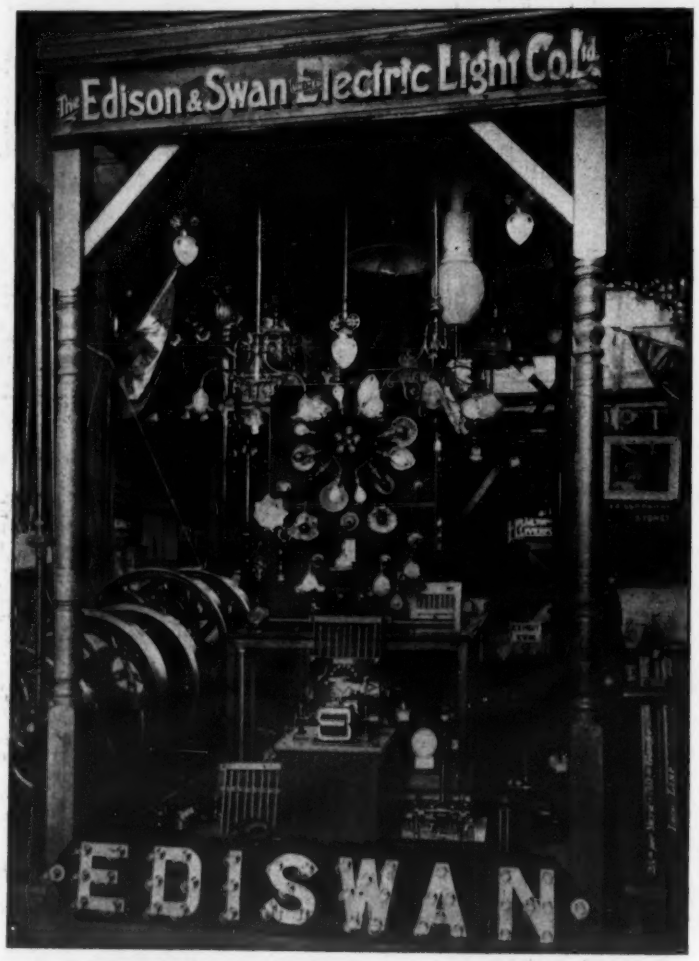
In the Edison-Swan exhibit was a complete equipment of their various lamps. Samples of the new 200-volt lamps of different candle power were shown, as well as many fancy and colored lamps. Switches for high-tension and low-tension circuits, surgical and operating lamps for hospital use, vacuum tubes for Röntgen rays, electric clocks. Steward inclosed-arc lamps and many other devices are



WILLANS ENGINES DIRECT COUPLED TO DYNAMOS, SYDNEY.

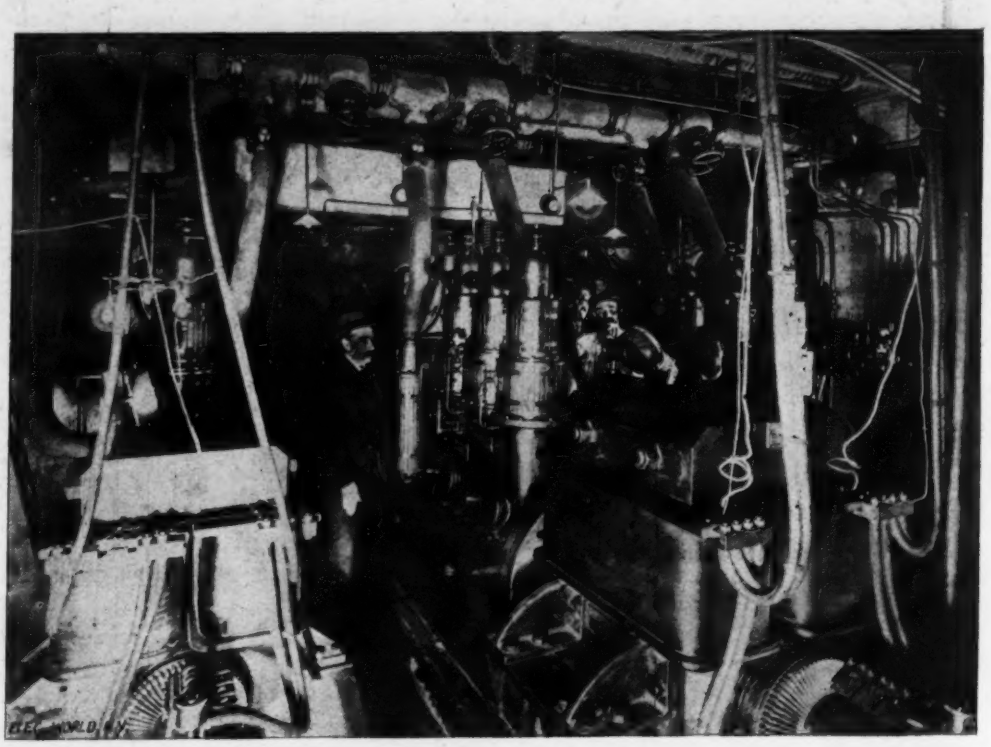
shown in this exhibit. The exhibit was lighted by an Edison & Swan 100-light dynamo, driven by a National Otto gas engine.

In the exhibit of Messrs. Siemens Bros. & Co., Limited, was an interesting electrical percussion rock drill. The drill itself resembles in appearance the ordinary pneumatic percussion drill, but the power is obtained from a small electric motor contained, with its starting rheostat, in a strong ironclad box. The motor is connected with the percussion drill through a flexible shaft. It is claimed that the consumption of power is about one-third that of the pneumatic drill on the same work. Among the other things in the Siemens exhibit was an electrically driven pump, two large continuous-current dynamos and several motors. The starting switches for these motors contain a device which is new to American engineers, viz., a shunt resistance, which is connected in parallel with the shunt winding of the fields before the field current is switched off. Its object is obviously to prevent the high-pressure discharge spark on opening the inductive circuit. The Siemens coulomb meter was also shown. This instrument, which in America would be called an ampere-hour meter, is of the clockwork type, and is arranged for working on the three-wire system. It is claimed that the meter will measure, with a maximum error of 3 per cent., all loads from 1 per cent. of its rated capacity up to full load on either side of the system. The meter is provided with an indicating device, so that the number of amperes flowing at any time can be seen at a glance.



The Edison & Swan Electric Light Co.'s Exhibit, Sydney.

The Brush Electrical Engineering Company, Limited, has also on exhibit a large variety of apparatus, among which was one of its Falcon vertical engines. In the Machinery Annex another of these engines was direct coupled to one of the company's Victoria



Dynamos Direct Driven by Willans Engines, Sydney.

dynamos, for supplying the light and power used in its quarters. Among other things shown by this company were a series arc-lighting machine, a motor coupled direct to a centrifugal pump, a complete switchboard for mining work, and another for high-tension alternating-current work. On the latter was shown the new method of mounting a fuse in a detachable porcelain tube, which forms a handle, by means of which the attendant can replace the fuse promptly without risk of shock. The same exhibit also contained an inverted arc lamp, the regulator being below the arc and the crater on the lower carbon. A large reflector was placed over the light, which gave a fine distribution of the light with no shadows, and with no one point of very high intrinsic brilliancy.

In the exhibit of Messrs. Edge & Edge there were many appliances familiar to American eyes. Among other things were the Walker Company's railway apparatus, the Ohio Brass Company's overhead material, the Interior Conduit Company's conduits, Lundell fan and power motors, Pittsburg Tool Company's lathes, Jandus arc lamps and Epstein accumulators.

In the exhibit of Messrs. Hamilton & Rutledge was an annunciator designed for use in the vestibules of modern high office buildings. In this system a series of buttons is arranged to signal to the various offices, by which any one can find out without going further whether the person he desires to see is in or out, the answer being electrically indicated on a dial.

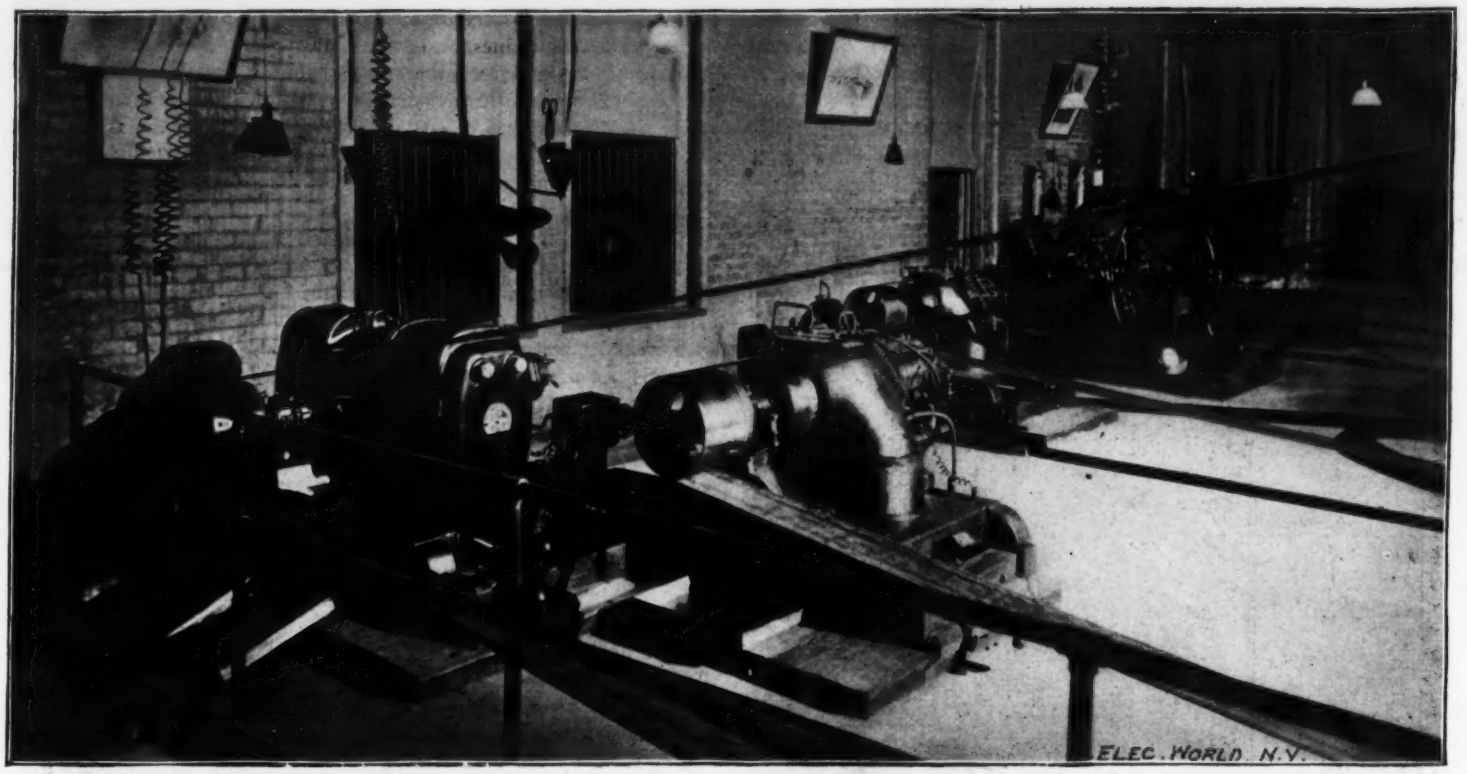
Messrs. Crompton & Co., Limited, had a large exhibit, comprising a great variety of electrical devices. A number of electrical cooking utensils were included in this exhibit.

The Babcock & Wilcox Company had a model of its boiler on show in a glass case.

The Westinghouse Air Brake Company also had an exhibit.

Electric Power for the Operation of Turrets on Battleships.

A Washington dispatch states that it has been decided to use electric power for the operation of the turrets on the new battleships "Alabama" and "Illinois," and it is thought that the "Wisconsin," which is now being built on the Pacific Coast, will be similarly equipped. Contracts have been awarded by the Navy Department by which each ship will be supplied with the necessary equipment for the operation of the turrets, at a cost not to exceed $10,000. The United States cruiser "Brooklyn" is fitted out with electric gear, which is said to work very satisfactorily.



FOUR OF THE GENERATORS, NEW YORK STATE INDUSTRIAL SCHOOL.

Electricity at the New York State Industrial School.

BY JOSEPH T. FREEMAN.

FIVE years ago there was installed at the State Industrial School, Rochester, an electrical plant for two purposes. One was to supply the institution with light and power, the other to furnish the means by which practical information could be given the boys in the care and construction of electrical machinery.

The management have been more than repaid by their venture into this additional trade, and the writer cannot refrain from saying that the result has been more than pleasing, and even surprising in the excellent service the plant has rendered the institution. Not since the wheels were first set in motion has the institution been inconvenienced by the absence of light on the incandescent system, due to mishaps or accidents in the electrical department.

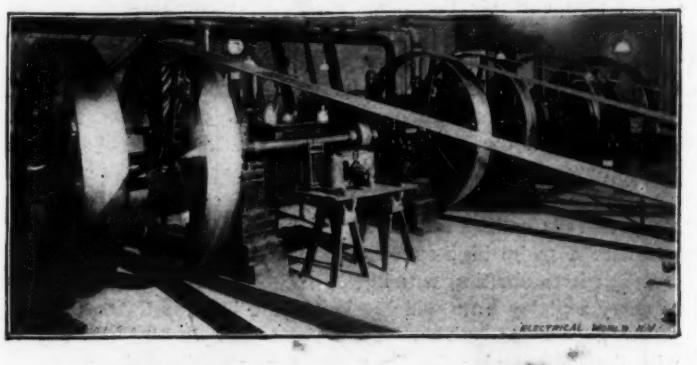
The plant first consisted of three Western Electric 30-kw incandescent dynamos and one 30-light arc machine. The driving power consisted of two 14 in. × 18 in. Stearns' high speed engines, rated at 125 horse-power each. These were connected, one at each end, by friction clutches direct to a jack shaft carrying four 6-foot pulleys for belting to the dynamos. It will be seen that either engine could be run and carry load, the power of both could be combined, and, in case of accident to one, a change to the other could be made with little inconvenience.

The steam is now furnished by a boiler plant of 1000 horse power capacity. The power boilers consist of three 75-hp Woodbury, Booth & Pryor return flue and two 150-hp Root water tube. The excess in boiler over engine capacity is due to the demand made by the engines in the shops, heating and cooking. The remaining boilers, of which there are six, are used for heating the many buildings, and do not carry a pressure over 40 pounds.

The coal consumption amounts to about 10,000 tons a year, and calls for no little skill in its handling. The law of 1896, abating the smoke nuisance, called for a change at the institution plant, and hard coal was substituted for the soft, which had been furnished by contract from local dealers. As it is now the coal comes by canal to a large shed, the capacity of which is equal to a year's supply. No trespassing is allowed, for the State property adjoins the canal, and the shed and railroad built for transporting coal to the boiler room are located entirely on its own grounds.

The building of the shed and railroad was laid out by the superintendent, the work being done by the cadets under the direct supervision of the instructors at the head of the carpenter, blacksmith, machine and mason shops. The farm squad are entitled to a part of the credit, for they did the grading, and placed the ties for the rails.

The plant was installed for an increase of 30 per cent. Instead

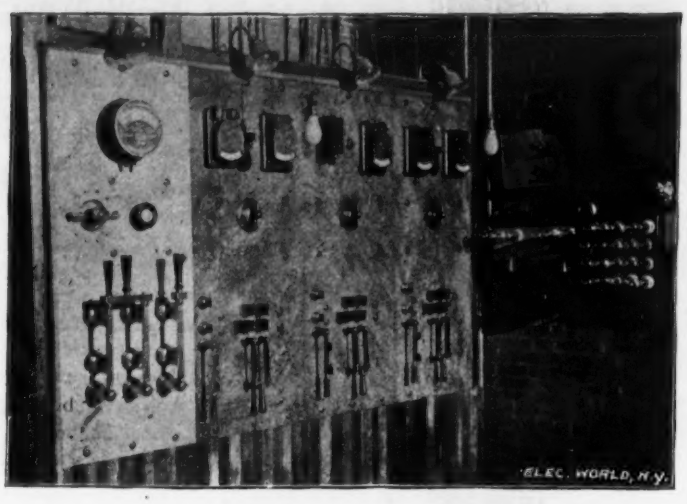


ENGINE, SHAFTING AND NEWLY BUILT 2½-HP MOTOR.

of its being increased that amount, it has been doubled, a fact hard to be realized, even by the management.

From 1500 lights the number has been increased to over 3000, and from a 15-hp motor to four 5-hp, one 15-hp, one 10-hp and two 2-hp. The additional motors, with the exception of the 10 horse-power, were all designed and built at the school, and are doing everyday service. From this it will be seen that the dynamo capacity originally installed would make a poor showing in handling the load that might be called for at any time. The heavy loads are confiened almost entirely to fall and winter, for the reason that most of the heating is done by fans, which are run by motors, and the shops being run until 6:15 at night call for many lights that are dispensed with during the long days.

The changes in the dynamo room were numerous for an isolated plant. A new 75-kw General Electric moderate speed generator was put in and belted direct to the west engine. This does not interfere with the engine being coupled to the jack shaft and driving the other dynamos. As a separate combination it is excellent, and more desirable to run than the other engine with its 24-foot shaft. The wires leading to the switchboard from the new generator were placed in a conduit next the south wall, and brought up back of the switchboard. The wires from the old dynamos were originally placed overhead on the ceiling, but, desirous of doing away with any overhead wiring, these were all taken down and placed in iron armored conduit.



The Switchboard.

The dynamos are all compound wound, and feed a two-wire system, which is used throughout the institution. The feed wires from each machine are supplied with the necessary switches, ammeters, controller, voltmeter and pilot lamps. A third bus bar was put in and is used as an equalizer; an objection to the old system being that the equalizing wires were all connected together, that is, with no switch.

It will be seen from this that no matter which machine was generating, the others would have live terminals. This made it unpleasant in handling the dynamos if a positive ground came on the system, the equalizing wire being on the negative side. A switch is now provided for each equalizing wire, and the same switch also controls the shunt coil. This combination seems to be free from objection, and the loads are changed about with rapidity and no deviation of the voltage. A combination voltmeter switch is used with the voltmeter, so that the pressure of any dynamo can be ascertained before cutting in on the system.

Ammeters of the Western Electric make are used on the three 30-kw dynamos, and a round type ammeter of the Weston make on the 75-kw. The boilers have been fitted out with automatic stokers—thus calling for additional power—and it was decided to purchase a 50-hp high-speed engine, place it in the power house, and belt it to shafting running to the boiler room, the same shaft to carry a pulley from which a belt could be brought to one of the 30-kw generators. This permits the carrying of the day load with the same engine that furnishes power to the stokers.

The engine is belted direct to a friction-clutch pulley, and can be operated at will. As the stokers require continuous power, and as no engine can run without cleaning and repair after a reasonable length of time, it is left for the dynamo, running as a motor, to carry the stokers while the engine is shut down.

The dynamo and engine room is 35 × 50 feet. The new floor is cement, and was put in by the mason-shop boys, under the direction of their instructor. A cement sewer, to which was connected the entire exhaust pipe system, and also an arrangement to carry off any surplus water were put in, thus permitting the piping to be carried entirely below the floor of the boiler room.

The 50-hp engine, which is a Woodbury, and made by the same company as the old ones, is fed by a separate steam pipe, and only in case of a complete shutdown in the boiler room is there likely to occur a shutdown in the power house.

The value of the work done in the plant can only be appreciated when it is stated that the entire change has been made, with the exception of setting up the new generator, by the cadets, under the supervision of the instructors. Worthy of mention is the setting up and aligning of the new 50-hp engine by the department itself. The changing of the wires from overhead to underground, with the new additions, was conducted with such care that no shutdown was made.

The temptation to close the circuit across the bus bar came to the notice of the electrician only once, and not from the fact that the offender was burned, but the "suddenness of the thing" scared him so that a repetition need not be looked for. The experimental faculty is ripe at the age of these boys, but its development is not nourished at the expense of the department.

The repairing done is as varied as the many electrical appliances. Nothing beyond the repairing of the testing instruments is done outside the institution. This includes repairs on motors, the starting boxes, the wiring of chandeliers, rewiring of new departments, caring for bell circuits, repairs on arc lamps and the trimming of the same. Not only is the work in the electrical field cared for, but that which is directly connected with it as well. As part of this may be mentioned engine work, caring for fans that are run by motors, and the wiping and cleaning of machinery in the power house.

A spacious room is located over the power room, where most of the repairs receive attention. Suitable machinery is to be placed here, and much of the work now done at the machine shop will be handled by the electricians.

To properly care for such a system calls for much work, and keeps the two instructors, with the aid of the boys, very busy, even to the extent of placing work entirely in the hands of boys. With experience gained, and under proper instruction, they have handled many jobs entirely alone, and much to the satisfaction of the management. Not wishing to create an erroneous impression as regards the work done by the boys, it will be sufficient to say that they are not different in many ways from other boys. Some are found indifferent and do not care, and from this class the instructor gets an excellent lesson in patience.

A new chapel, built at a cost of $60,000, calls for nearly 50 horse power. This is consumed in a 10-hp motor, used for driving a 6-foot Sturtevant fan for heating and ventilating, a 1½-hp motor, built at the school, for automatically driving the bellows of the organ; eighty 16-cp lamps for lighting the basement, which is used for a lavatory, and 400 16-cp lamps for lighting the auditorium and stage.

Assembled Parts of 20-HP Motor Nearly Completed.

The electrical organ, the only one in the city, was installed by Farrand & Votey, of Detroit. Storage batteries charged through a bank of twelve 16-cp lamps are the source of power.

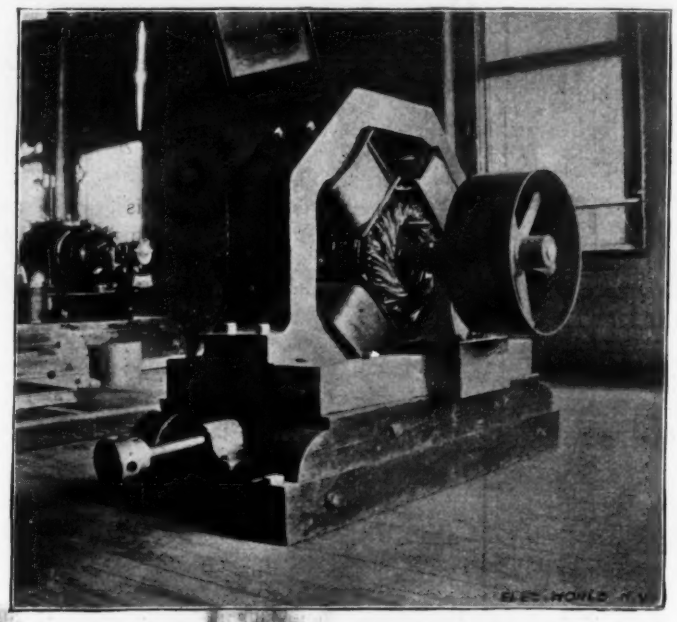
The other buildings, of which there are fourteen, are well lighted with incandescent lamps, the exception being the drill hall. This is a building 350 × 150 feet, and will be lighted by fourteen 2000-

cp arcs, placed on the incandescent system. Until this time the building has been lighted by arc lamps on the series circuit, but owing to the desire to do away with the high-tension system a movement is on foot to replace all series arcs with arcs on the 110-volt system. This will permit the use of any lamp at any time without starting a special dynamo.

The construction work is so varied and takes the department into so many branches of the electrical field, that even to the initiated much of interest presents itself.

An important factor to the work of laying out machinery, and one which causes much necessary delay, is the fact that the machine shop is not fitted with machines of sufficient size to handle dynamos and motors that could safely be built at the institution. From this it will be seen that the designer has to adapt his work to the handling capacity of the machine shop, as well as to the laws governing the mechanical and electrical construction of machines.

The lighter work, under the head of construction, consists of



15-HP Motor Built at the School.

wiring, running new circuits and putting in the necessary cut-outs and switches. Many bell circuits have been run, which call for considerable time in the care of the batteries and the keeping of the system in working order.

Conduit work is becoming quite extensive, and in all probability the wires from the arc lamps will be placed underground and connected to the 110-volt system. This would give better service in the yards, the present lamps being mounted on tall poles leaving many places in shadow, which fact calls for much attention on the part of the yard officers.

The boys received a bit of experience last year which was a novelty in many ways. It was decided by the superintendent that at the camp where the boys were to have a week's outing electricity should play a part in the way of lighting the grounds. Many perplexing questions presented themselves to the electrician at the time, but are now the subject for much amusement. The plant as installed consisted of a 15-hp motor, used as a generator. This was belted direct to the source of power, which was an engine, somewhat aged, but useful still. A date of 1872 was found on it, and it is needless to say that so far as automatic regulation was concerned it did not compare favorably with the latest examples of engineering skill. The man at the switchboard presented a troubled look when he found the voltage dropping, and then went out to see what the prospects were for a little more speed. The old engine put up a glorious fight to keep pace with what modern engineering called for, and, with a sheet of flame from her fire-box to 6 feet above the stack, took one back to historic days on the Hudson.

The scene in the dynamo room was less brilliant, but the light more uniform, and the dynamo had much less room than the engine, which was not under cover. A marble switchboard, mounted in a suitable frame, and fitted out with the necessary instruments, completed the equipment at the power house, with the exception of a 16-inch fan and motor used to blow away mosquitos. From here the main line extended to the tents, which were located from 500 to 800 feet away. About 3000 feet of wire was used, and each tent was provided with two lights; a bank of sixteen 20-cp lamps was placed on a tall support, and presented a brilliant appearance at night. Tents were put up to accommodate 900 people, and, considering that only two days was given for setting up dynamo and wiring, the results were excellent.

The greatest saving that has come to the institution has been through the motors. Seven out of the nine now in use were built at the institution. Nothing has been borrowed, and no finished product purchased. They are home made. From the drawings the patterns are made, from the patterns the castings, and from the castings the finished material, which the winding department receives ready for the wire.

The instructors in the pattern shop, the foundry, the machine shop and electrical department must necessarily keep in close touch to bring success to the completed machines.

The first output in the motor line consisted of a 5-hp shunt motor of 1600 r. p. m. It was of the vertical type, with the yoke at the base, and its armature supported by projected arms cast on the pole pieces. This construction was changed in the other three, the arms being bolted on instead of cast, which is found much more desirable. Self-aligning and self-oiling babbitted brass bearings were used. The first three motors were used to drive 4 foot fans, fans, for heating and ventilating. Their service has been excellent, and until this time no renewals have been necessary on the first one constructed. The speed was found to be more than was necessary on mild days, and was reduced on two of them by cutting them in series. This is an excellent way where motors are located in the

Electric Clock and Watchman's Time Detector.

same building, and where an unnecessary waste of energy is a thing to be avoided. The fourth motor is now used for driving a five-barrel Durand dough-kneading machine.

The next motor completed was a 2½ horse-power, with a speed of 2500 r. p. m. It was made up of two cylindrical wrought iron fields bolted between the yokes and pole pieces, projecting arms being cast on the lower pole for supporting the pedestals and bearings. The machine has been re-designed into a 1½ horse-power, 1600 r. p. m. The bearings are brass and self-oiling; the commutator is mounted on a wrought-iron sleeve and keyed to the shaft. Thirty-two segments are used, with the best mica insulation, and sloted for receiving several wires. These are soldered and wound over with wire, with mica insulation between. Careful tests have not yet been made, but it promises remarkable efficiency for a small machine. The motor is being used in the tailor shop for driving sewing machines.

The next venture was to build a 15-hp four-pole shunt motor, with a speed of 850 r. p. m. The illustration gives an idea of the results obtained by efforts in that direction. While it presents a

very creditable appearance, its running more than makes up for what it may lack in finish, and it is doubtful if many motors are put to a more severe test than this one was. Previous to its present location, and while the new generator was being installed, the motor was lined up and belted direct to the East engine, and run as a generator. As the engine is of 125-hp capacity, there was left but one of two things to do, either break down and go to pieces or take care of everything that was called for on the line. The machine was taxed at all times beyond what good judgment would permit, but for all that no accident of any description happened during a month's run.

The motor, which weighs 2400 pounds, is made up of a solid cast-iron yoke, bolted to a cast-iron bed plate, and all mounted on a neat sliding oak base.

The fields are of cast iron and shunt wound. The pedestals for bearings are bolted direct to iron base, thus not only making a solid construction, but making it exceptionally easy to get at the bearings, a point not considered in many of the multipolar machines built.

The bearings are self-oiling and self-aligning and call for an exceptionally small amount of oil. The motor for the past seven months has averaged twenty-two hours every day, and for a load runs shafting from which are belted two 4-foot fans running at 400 r. p. m.

A new motor of 20-hp capacity is nearing completion. In general appearance it is similar to the 15-hp, but in its make-up much more work is called for. The core is made up of a cast-iron web, or spider, keyed to shaft. Keyed to the spider are discs compressed and held together by two one-quarter-inch steel plates, bolted to spider arms by eight half-inch bolts. No bolts pass through discs. The commutator is made up of sixty segments, mounted on two cast-iron plates drawn together by six half-inch bolts. Considerable air space exists between the plates, and good ventilation will be obtained by openings in the end plate next to armature. The fields are cast steel, and the only castings not made in the institution. They are to be compound wound for close regulation. Lap winding will be used on the armature, and everything in the way of good insulation will receive special care. The whole construction is on lines conforming to the best engineering, and the writer is confident that its performance will compare well with that of machines coming from shops having no obstacles to overcome in construction work.

The part that electricity plays in the everyday life of the institution has been mentioned. Electro-plating and electric heating have been successfully done on a small scale. The independence shown in all lines of work is of itself an exciter of interest. The electrician is desirous of putting all the motors on a 220-volt system, which would call for a 75-kw generator. It is not the intention to buy this dynamo, but to build it. This will be placing knowledge within the reach of those who have not had the advantages of a higher education, and who, though unfortunate, will be able to apply themselves hereafter in a practical way.

It does not seem out of order in concluding this article to speak of the value of trade instruction in such institutions as the State has found it necessary to provide. Two things are accomplished in trade instruction. Beside keeping the youthful minds occupied, they are given information of practical value—a knowledge that will permit of their working at some trade intelligently. The development of electricity is creating a demand for men who can asume the duties of a plant understandingly, and the writer feels safe in saying, after coming in contact with many men who hold subordinate positions, that their true worth would be much increased through an addition of such knowledge as is given and comes through trade instruction.

Granted that in the end the college man gets and holds the best position, there are intermediate steps that have weight and responsibility, and where the work must be done with thought and care. The electric plant of to-day, from a mechanical point of view, represents many professions, and to be run successfully and economically must be manned by men of intelligence. The ready way in which some of the boys from the Rochester school have applied themselves is evidence of the value of the instruction given, and instead of having the name unfortunate, the paroled boy may well term himself fortunate in having been clothed with knowledge that will permit of a legitimate livelihood.

Alternating-Current Machinery—XIX.

BY EDWIN J. HOUSTON AND A. E. KENNELLY.

MUTUAL INDUCTANCE.—(*Continued.*)

161. If a resistance of R ohms in a continuous-current circuit, represented diagrammatically at A, Fig. 110, be shunted, or conductively associated with a second resistance r ohms as at B, Fig.

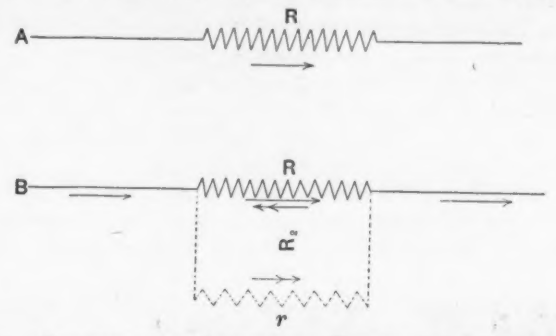


Fig. 110.—Conductively Associated Resistance in a Continuous Current Circuit.

110, then we know that the resistance of this portion of the first circuit, which was R ohms (at A) is now $\frac{Rr}{R+r}$ ohms (at B). If $R+r$, the resistance of the closed circuit formed by both resistances, be denoted by R_2, then the effect of closing the shunt circuit is to reduce the resistance in the main circuit from R to $\frac{Rr}{R_2}$, or to make an alteration in the main circuit of $-\frac{R^2}{R_2}$ ohms. This may be regarded as a negative resistance added to the main circuit, and we may express the facts by saying that the apparent resistance R_{app}, of the second or shunt circuit in the main circuit is $R_{app} = -\frac{R^2}{R_2}$ ohms. For example, if $r = R$, $R_2 = 2R$ and $R_{app} = -\frac{R}{2}$ ohms; or, the conductive association of a resistance R, in shunt with a resistance R, in the main circuit has introduced an apparent resistance of $-\frac{R}{2}$ ohms in the main circuit.

Again, if I be the current strength flowing through the main circuit at A, Fig. 110, the drop of pressure or E. M. F. between the

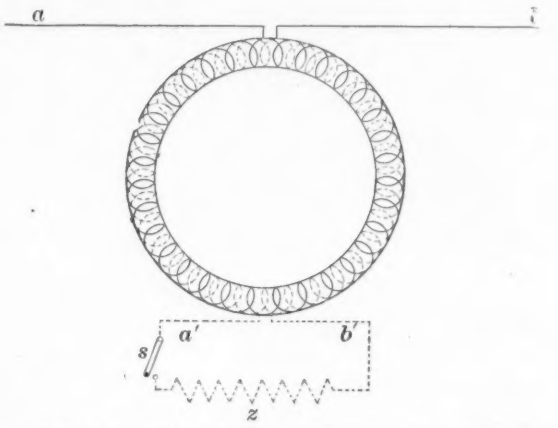


Fig. 111.—Induction Coil of Equal Reactance and Interactance.

terminals of R will be IR volts. We may, therefore, consider that at B, Fig. 110, an E. M. F. of $-IR$ volts acts in the circuit $R+r$, establishing thereby a current of $-\frac{IR}{R+r}$ amperes $= -\frac{IR}{R_2} = -I\frac{R}{R_2}$ amperes; or a current of $I\frac{R}{R_2}$ in the opposite direction to the main current in R.

162. If a closed circular core or tore be wound uniformly and symmetrically with two windings of insulated wire, the same number of turns being in each winding as diagrammatically indicated in Fig. 111, then we obtain an inductive association of the two windings in which the self-inductance L_s henrys of either is equal to the mutual inductance L_u henrys between them. Consequently if one of these windings, say ab, indicated by hard lines, be inserted in a primary circuit, or be traversed by a simple alternating current of I amperes effective, at a frequency of n cycles per second, or at an

angular velocity of $\omega = 2\pi\eta$ radians per second; while the second winding is arranged for closing upon a secondary circuit through a switch s, and impedance Z; the reactance in each winding will be $jX = jL_s\omega$, and the interactance between the windings will be $jX_u = jL_u\omega$. In this particular induction coil we have, therefore, $jX_1 = jX_u = jX_2 = jX$, or the primary and secondary reactances are each equal to the interactance.

The conditions of Fig. 111 are diagrammatically shown at Fig. 112. At A the primary winding is inserted in the primary circuit, and

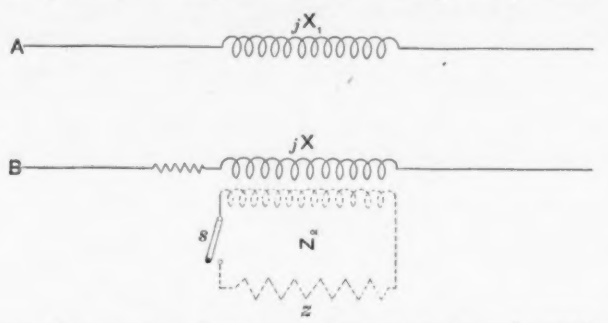


Fig. 112.—Inductively Associated Impedance in an Alternating-Current Circuit.

offers an impedance $Z_1 = R_1 + jX_1$ ohms where R_1 is the resistance of the winding, and jX_1 is its resistance. At B the secondary winding is shown with a switch s for closing the secondary circuit through a total circuit impedance of Z_2 ohms. Then the effect of closing the switch s is to introduce into the primary circuit an apparent impedance of $Z_{app} = \frac{-(jX)^2}{Z_2}$. For example, suppose that the external impedance z in the secondary circuit is zero, so that the secondary coil is directly short-circuited, and that the ohmic resistance of the secondary winding is negligibly small. The secondary impedance Z_2 then practically becomes reduced the reactance $jX_2 = jX$. Consequently $Z_{app} = \frac{-(jX)^2}{jX} = -jX$. This is the apparent impedance added to the primary circuit by short-circuiting the secondary, and shows that the primary reactance jX_1, which exists when the secondary circuit is open, is then virtually cancelled. The ring induction coil will, therefore, when its secondary winding is short-circui ed, behave as though its primary were also short circuited, neglecting the ohmic resistances in both windings.

Again, if I be the current strength flowing through the main or pri mary circuit at A, Fig. 112, the drop of pressure or E. M. F. between the terminal of jX will be jIX volts. This is as though an E. M. F. of $-jIX_u$ volts effective acted in the secondary or inductively associated circuit, establishing thereby an effective current strength of $-j\frac{IX}{Z_2} = -I\frac{jX}{Z_2}$.

163. It is evident, therefore, that with an induction coil of equal reactances and interactance, the effect of closing the inductively associated circuit through an impedance Z_2 is the same as closing a conductively associated circuit through a shunt of impedance Z_2, the interactance X_u being the portion of the primary circuit to which the imaginary shunt Z_2 is applied.

164. When the interactance jX_u between the primary and secondary coils is no longer equal to each of the reactances jX_1 and jX_2, the analogous case in the continuous-current circuit is not quite so simple, but the apparent impedance of the secondary circuit is always $Z_{app} = \frac{-(jX_u)^2}{Z_2}$ ohms, the secondary impressed E. M. F. is always $E_2 = -Ijx_u$ volts, and the secondary current $I_2 = \frac{E_2}{Z_2} = \frac{-Ijx_u}{Z^2}$ amperes.

165. It is important to analyze the above relations somewhat closely. Z_{app} may evidently be written $Z_{app} = -(jX_u)^2\ Y_2$ ohms, where Y_2 is the admittance $\left(\frac{I}{Z_2}\right)$ of the secondary circuit, or the vector reciprocal of the impedance of the secondary circuit. The apparent impedance of the secondary circuit in the primary is therefore equal to the negative product of the secondary admittance and the square of the interactance.

166. Fig. 113 supplies a convenient means for converting any given impedance into its approximate corresponding admittance. Along the top horizontal line $o\,g$ are the centres of a series of circles marked from $r = 100$ to $r = 0$. Similarly along the left-hand

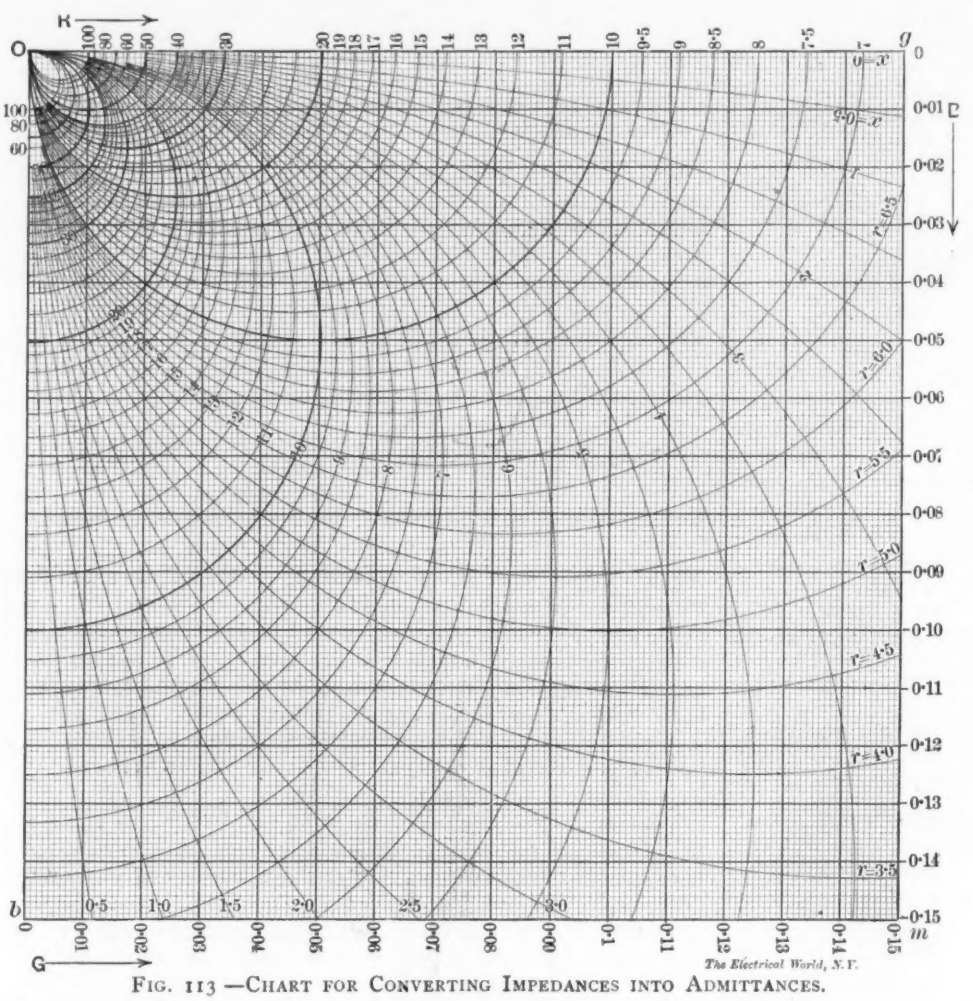


Fig. 113.—Chart for Converting Impedances into Admittances.

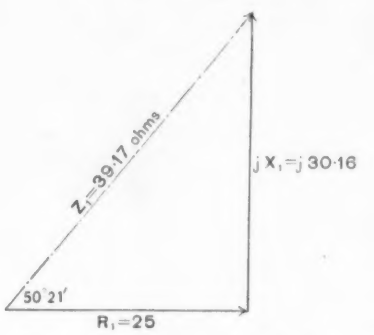


Fig. 114.—Primary Impedance.

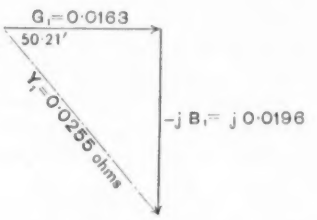


Fig. 115.—Primary Admittance.

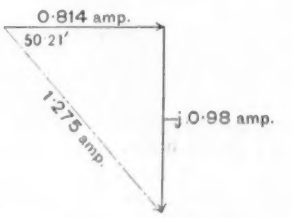


Fig. 116.—Primary Current.

vertical line $o\,b$ are the centres of a series of intersecting circles marked from $x = 100$ to $x = 0$. If, then, we select any pair of complex quantities composing an impedance, such, for example, as $Z = r + j\,x = 10 + j\,10$, the intersection of the heavy circle $r = 10$ with the heavy circle $j = 10$ is found at a point whose rectangular co-ordinates are $G = 0.05$ and $B = -0.05$, as marked on the bottom and right-hand side of the figure. The admittance $\frac{1}{10 + j\,10}$ is, therefore, $G + j\,B = 0.05 - j\,0.05 = 0.07070\ /\overline{45°}$. That this is true is evident from the fact that the impedance $Z = 10 + j\,10 = 14.14\ /\overline{45°}$, and the reciprocal of this, or

$$\frac{1}{Z} = \frac{1}{14.14\ /\overline{45°}} = 0.0707\ /\overline{45°}.$$

Again, the admittance corresponding to the impedance $1.0 + j\,1.0$ is a vector whose components are ten times larger than in the preceding case, or $0.5 - j\,0.5$.

Again, the admittance corresponding to the impedance $Z = 15 + j\,30$ is found in the diagram to be at $G = 0.0133$ and $B = -0.0266$, so that the admittance $Y = 0.0133 - j\,0.0266$ mho.

When $X = O$ $B = O$, and the admittance is reduced to a conductance $G = \frac{1}{Z}$.

When X is negative, B has a positive value, and is the same as that found in the figure, but with the sign reversed. Thus the impedance $Z = 15 - j\,30$ ohms, corresponds to an admittance $Y = 0.0133 + j\,0.0266$ mho. By inspection of the curve sheet, Fig. 113, any impedance may be made to supply the corresponding admittance, or vice versa, within a reasonable degree of accuracy.

167. As a simple case we may consider an induction coil as described in Section 153, in which the resistance of each winding is 25 ohms, and the inductance is 0.08 henry. The mutual inductance is also 0.08 henry. Let us suppose that one of these windings, considered as the primary, is connected to a pair of constant potential, simple alternating-current mains of 50 volts effective pressure, and 60 ~ frequency. The angular velocity of this frequency is $\omega = 2\,\pi \times 60 = 377$ radians per second. The reactance of each winding is, therefore, $j\,l_s\,\omega = 0.08 \times 377 = j\,30 - 16$ ohms, and the interactance $j\,l_u\,\omega$ will also be $j\,30.16$ ohms. Then with the secondary circuit open, the impedance of the primary coil will be $Z_1 = R + j\,X = 25 + j\,30.16 = \sqrt{(25)^2 + (30.16)^2}\ /\overline{\tan^{-1}\frac{30\text{-}16}{25}} =$ $39.17/\ \tan^{-1}\ 1.2064 = 39.17\ /\overline{60°.21'}$. (Fig. 114.) Consequently, with the secondary circuit open, the current which will flow through the primary coil from the constant potential mains will be $\frac{50}{39.17\ /\ 50°\ 21'} = 1.275\ /\overline{50°\ 21'}$ amperes. This might also be determined from Fig. 113, since the admittance corresponding to $r = 25$ and $j\,x = 30.16$ is found to be $G = 0.0163$ and $-j\,B = 0.0196$. The admittance of the primary is, therefore, $Y_1 = 0.0163 - j\,0.0196$ (Fig. 115), and the current strength $EY_1 = 50\ (0.0163 - j\ 0.0196) =$ $0.815 - j\,0.98 = \sqrt{(0.815)^2 - (0.98)^2}\ /\overline{\frac{\tan^{-1} - 0.98}{0.815}} = 1.275$ $/\tan^{-1} - 1.2025 = 1.275\ /\overline{50°\text{—}15'}$ (Fig. 116) amperes, the same result. The component of current 0.815 ampere, cophasal with the pressure, is the active component, and is expended in heating the primary coil. The activity of this cophasal component is $E\,I_e = 50$ volts $\times$ 0.814 ampere $= 40.70$ watts. This is the same as $I^2\,R = (1.276)^2 \times 25 =$ $1.628 \times 25 = 40.7$ watts. The component of current in quadrature, with the pressure 0.983 ampere, is the wattless component, since on the average it takes no power, and it is employed solely in magnetizing the primary coil, *i. e.*, in producing the alternating magnetic flux.

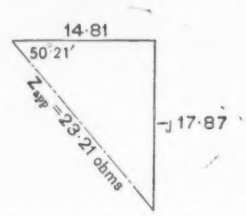


Fig. 117.—Apparent Impedance of Secondary in Primary Circuit.

168. Next suppose that the secondary coil is closed upon itself or short circuited. Its impedance, like that of the primary, is $Z_2 = R_2 + j\,X_2 = 25 + j\,30.16$, while the interactance, $j\,X_M$ is $j\,30.16$. Consequently the apparent resistance of the secondary circuit as it appears in the primary circuit is

$$Z_{app} = -\frac{(j\,X_M)^2}{Z_2} = -(j\,X_M)^2\,Y_2.$$

We have already seen that $Y_2 = \frac{1}{Z_2} = \frac{1}{Z_1}$

$= 0.01628 - j\ 0.01965$ mho, so that

$Z_{app} = -(j\ 30.16)^2\ (0.01628 - j\ 0.01965)$

$= 909\ 62\ (0.01628 - j\ 0.01965)$

$= 14.81 - j\ 17.87$ ohms. (Fig. 117.)

$= \sqrt{(14\ 81)^2 + (17\cdot87)^2}\ /\overline{\tan^{-1}\frac{-17.87}{14.81}} = 23.21\ /\overline{50°.21'}$

The impedance of the primary circuit is now

$Z_1 + Z_{app} = 39.17\ /\overline{50°.21'} + 23.21\ /\overline{50°.21'}$

$= 25 + j\ 30.16 + 14.81 - j\ 17.87$

$= 39.81 + j\ 12.29 = 41.66\ /\overline{17°.9'}$

The current in the primary circuit therefore becomes $\frac{50}{41.66/\overline{17°.9'}} =$ $1.200/\overline{17°.9'}$ (Fig. 119), or slightly less than before. The cophasal component is $1.200 \cos 17°\ 9' = 1.200 \times 0.9555 = 1.1466$ amperes. The wattless or quadrature component is $j\ 1.200 \sin 17°\ 9' = 1.200 \times$ $0.2949 = j\ 0.3539$. The activity expended in the primary circuit is $I^2 R_1$ (Fig. 118), or $(1.200)^2 \times 25 = 1.44 \times 25 = 36$ watts. The activity expended in the apparent resistance of the secondary R_{app} (Fig. 118) is $(1.2)^2 \times 14.81 = 1\ 44 \times 14.81 = 21.33$ watts, making the total activity delivered to the primary $36 + 21.33 = 57.33$ watts. We should therefore expect to find 21.33 watts in the secondary circuit.

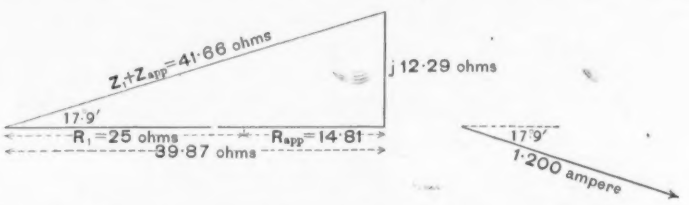


Fig. 118.—Total Apparent Impedance of Primary with Secondary Circuit Closed.

Fig. 119.—Primary Current.

The secondary E. M. F., as we have seen, is

$-j\,X_M\,I_1 = -j\ 30.16 \times 1.200\ /\overline{17°.9'} = 36.192\ /\overline{107°.9'}$ volts $= E_2$.

The secondary current will be E_2/Z_2 or

$$I_2 = \frac{36.192\ /\overline{107°.9'}}{39.17\ /\overline{50°.21'}} = 0.924\ /157°\ .30'\ \text{amperes}$$

$$= -0.854 - j\ 0.3536\ \text{amperes}.$$

The activity in the secondary circuit is $(0.924)^2 \times 25 = 0.8539 \times 25$ $= 21.33$ watts. So that the 21.33 watts which were delivered in the primary circuit to the apparent secondary resistance, are found to be delivered in the secondary circuit to its actual resistance.

In this case, therefore, the effect of short-circuiting the secondary coil is to change the primary current from $1.276\ /\overline{50°\ 21'}$ to $1.200\ /\overline{17°\ 9'}$ and the primary activity from 40.70 to 57.33 watts, of which latter 21.33 watts are transferred to the secondary circuit.

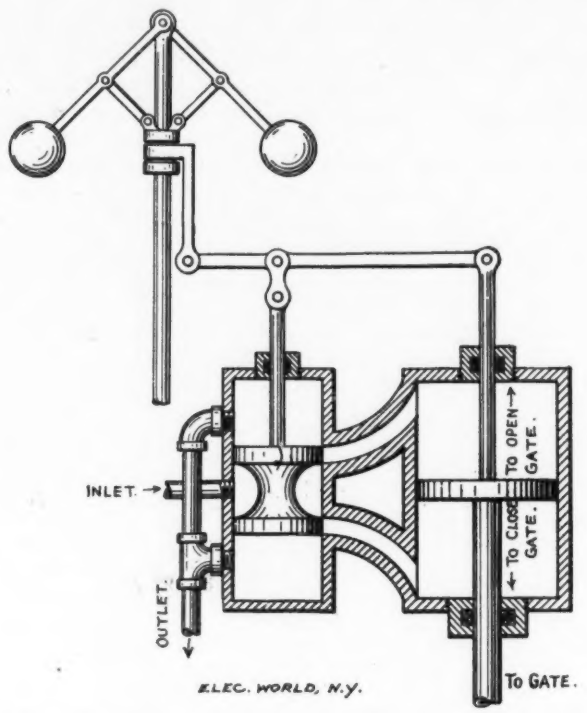
The Governing of Dynamo-Driving Water Wheels.

The rapidly extending use of water falls for power generations and the transmission of such power electrically has caused a remarkable development of the various types of water wheels and water-wheel governors. The problem of governing for such purposes is a peculiarly difficult one. The governing of steam engines used for electrical generation has gradually been brought to a state of approximate perfection, but the same can hardly be said of water-wheel governing. The difficulties are several. In the first place, the weight of the gates to be moved and the resistance of the rushing water to their movement are considerable. This difficulty makes it impossible to control the gates directly by the force of a centrifugal governor, as is done in the steam engine. The relay principle in some form or other must be employed.

Wherever the water power is generated at the end of a long closed-pipe line, or at the foot of a long penstock, the inertia of the moving column of water introduces another serious problem. The closing of the gate, for example, raises the pressure at the wheel, due to the persistence of the motion. In case of an abrupt closure of the

gate the long column acts virtually as a water hammer, raising the pressure enormously. The chief difficulty, however, is found in the attempt to properly govern wheels driving alternating machines, which it is desired to run in multiple.

If, as very often is the case, there is no need of economy in the governing, the problem is very easily solved. For example, in one plant, described in THE ELECTRICAL WORLD of September 4, 1897, the necessity of governing was entirely obviated by maintaining a constant load on the dynamos. An artificial load was varied in such a way as to make the sum of the useful and artificial load a constant. A very similar method of handling the problem is adopted by the manufacturers of the Pelton water wheel whenever there is no occasion for economizing the water consumption. The Pelton wheel, as is well known, is of the impulse type; and when the load falls it is governed by deflecting the nozzle or nozzles so that only a part of the water flowing strikes the buckets. In this way the wheel can be readily governed over its whole range of load, but it is needless to say that the consumption of water is as great at any load as at full



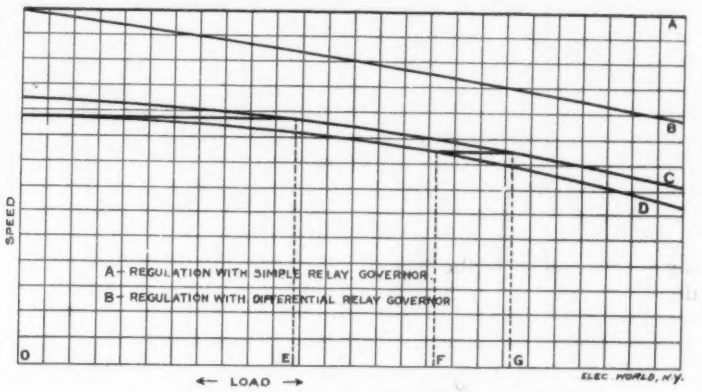
DIAGRAMMATIC VIEW OF DIFFERENTIAL RELAY GOVERNOR.

load. A plant with wheels of this type was described in THE ELECTRICAL WORLD of March 13 and 20, 1897. A somewhat similar method is often adopted for other wheels by opening by-pass valves as the main valves are closed. In this way the flow of water is kept constant under all changes of load, preventing the water-hammer action of long columns or pipe lines.

Another system which accomplishes the same result in part is the governing of impulse wheels by throttling, not immediately at the orifice, but at some point in the conduit leading to the nozzle. According to the well-known theory of impulse wheels, the linear velocity of the buckets should be one-half that of the jet issuing from the nozzles for maximum efficiency. By reducing the nozzle openings the power delivered may be changed with no considerable variation of efficiency, as the velocity of the jet and the velocity of the wheel remain practically constant. If, however, the stream is throttled at any point back of the nozzle the velocity of the jet diminishes; hence the efficiency of the wheel falls off rapidly. In this way the wheel can obviously be governed with a less variation of the water delivery than if the governing is done at the nozzle orifice. In other words, a reduction of the power delivery by 50 per cent. will be caused by a reduction of the water delivery of considerably less than 50 per cent. A plant in which this ingenious system is used was described in THE ELECTRICAL WORLD of October 16, 1897. In this plant an arrangement was devised for bringing up the efficiency at low loads at the will of the operator, by the use of an adjustable orifice manually controlled. The manual control can be made as gradual and slow as is necessary, while the automatic governing, which is at times necessarily swift, throttles the water back of the orifice, for the reasons above described.

A problem in water-wheel governing, greater than either of the foregoing is found in the proper governing of wheels driving alternators for multiple running. Alternating-current dynamos when run in multiple force each other into mathematically exact synchronism. The effect on their turbines is the same as though they were coupled or geared to the same shaft. The result of this on the different types of governors can be readily foreseen.

Water-wheel governors are now almost universally of the relay type. They employ, to operate the gates, either the power of the main shaft, the power of an auxiliary hydraulic cylinder, or electric power. In any case the governors may be divided into two general classes: Those in which the relay is controlled by the governing device alone, and those in which the relay is governed differentially by the governing device and the movement of the gates. The accompanying sketch shows diagrammatically a form of the latter in which a hydraulic relay is used. However, the general principles described below apply, whatever the power used to operate the relay. In this sketch it may be seen that the valve is controlled differentially in such a manner that as the load rises the governor balls must fall to retain the valve in the neutral position, and hence the speed must necessarily fall, and vice versa. In this way the action of the governor becomes very similar to that of the ordinary steam engine governors. Without this differential principle, it is obvious that the governor is isochronous in its action, or if not isochronous it at least maintains the speed between constant upper and lower limits, independent of the load. With this differential arrangement the governor still controls the speed between an upper and a lower limit, depending largely on the friction of the governing mechanism; but these limits fall as



LOAD AND SPEED CURVES.

the load rises. This may be represented graphically by the curve *B* in the speed diagram. When two alternators are run in multiple the respective outputs depend, as is obvious from the law of conservation of energy, of the respective inputs, assuming, as is the case, that the efficiencies are approximately the same. As the alternators run necessarily at mathematically the same speed, the division of the load will depend, simply and solely, on the relative positions of the gates at that speed. The curves, *C* and *D*, represent graphically an assumed case of regulation of two governors, one of which tends to govern at a slightly higher speed than the other, the fall in speed of both with increase of load being the same. It is obvious that with any given load the governors will set their wheels at such a speed that the output of both units will equal that load. When the load, for example, equals *OF*+*OG*, the division will be in the ratio *OF* to *OG*, as the machines must run at the same speed. When, however, the load equals *OE*, one machine will take it all, the other running light.

As the two curves approach isochronism the division becomes less stable, and at isochronism it is obvious that the division is in a state of neutral equilibrium. If the speed of the machines increase with the increase of load, the division would be in a state of unstable equilibrium. The case, however, of two isochronous relay governors is the most interesting, because it occurs very frequently in practice. If one governor tends to control its wheel within limits above those of the other, as the load rises the first machine will take it all until its gates are wide open, the second machine running with closed gates, owing to the fact that it is dragged up by the motor action of

its generator to a speed where its governor closes its gates. When the external load plus the drag of the slower machine exceeds the power of the faster machine at open gate, the speed will be held down to such a point that the governor of the slower machine will begin to act, and from that point until full load of both machines is attained, the governing will be done by the slower machine, the first machine working on wide-open gate. The same principle applies to more than two generators. In case the possible variation of speed of the two governors overlaps each other, the action becomes very complex, the distribution being in unstable equilibrium at any point. This difficulty can be readily overcome, as it is overcome in steam-engine practice, by so working the governors that they will cause the power units to slow down as the load rises. The greater the slowing down effect the more nearly equal will be the division of the loads, other things remaining the same. This remedy, however, renders the operation of the machines less satisfactory, as the fall of speed causes a fall of voltage with increase of load.

Another way of accomplishing the same result is to make the one governor control through one relay all the wheels. In this way the power input of the various wheels can be rendered proportional to their relative sizes on any and all loads. The electrical output of the wheels, as was pointed out above, must necessarily be equal to the power input minus the small losses in the machine. By varying the field strength the phase relations of the machine may be varied and the idle currents between machines properly reduced, but the division of the load can only be adjusted by proper control of the power input.

Another ingenious method of accomplishing the same result is used in some plants equipped with the Pelton wheels, notably the Regla-Pachuca plant referred to above. In this plant a separate turbine is driven without load to give approximately constant speed. The different gates are controlled respectively by differential motion of this constant speed turbine, and their respective machines. If the governors are thrown into action with the gates at a similar opening, they will all necessarily work together.

Storage Batteries on the Stage.

BY H. BISSING.

Storage batteries—the cause of many sleepless nights for the stage electrician—are being brought more prominently into use on the stage than ever before. They can be used with a comparative degree of comfort and, perhaps, success, and are the means of producing numerous effects which would otherwise be impractical, if not totally impossible. The producer of an extravaganza or burlesque requiring electrical effects of various kinds is always ready to suggest storage batteries for any particular effect in which at first glance the use of feed wires is impracticable, and it usually is the lot of the electrician working under his direction to contrive, by what means he may be able, to use feed wire and avoid the storage batteries; for if he has much traveling experience he will remember towns he has visited, where the only direct current was either the trolley circuit or the exciter to a 2000 volt generator. In these towns the station superintendent is sure that your little 5-ampere hour cells take at least 25 amperes charging current, and that he is carrying all the load he can possibly put on his machines; or he will pick up one of the batteries, examine it skeptically, incidentally spill the acid over himself, and then claim he believes they are worthless anyway, and finally that you can charge them at his station. All this, including the hunt for the station in the first place, has taken two or three hours' time; it is now 7 o'clock, and you have just one hour to have your battery charged and get to the performance. After you have gone through this experience several times you begin to think that life and storage batteries are a burden. Your manager, however, wants to know why the batteries are not working. "The best feature of the performance is cut out," he claims. (By the bye, let us say to the uninitiated, that no matter what effect is unavoidably cut out for a night, it is sure to be the best one.) You explain to him that you can't get the right kind of current for charging the batteries. You try to explain the difference between alternating and direct current, but he only points to the incandescent lamps burning in the footlights, and says: "You always charge your batteries with these; why don't you do it here?" Without waiting for further explanations he walks off, for the average theatrical manager has a perfect contempt for matters electrical.

Although it is best to avoid the use of storage batteries as much as possible, nevertheless there are some marches, ballets and individual effects where the storage battery is indispensable. In an aerial ballet, which consisted of several girls swinging two and fro suspended by a finely tempered steel wire, while multi-colored lights, in the shapes of butterflies, etc., were thrown upon them, the effect was greatly increased by the addition of a few 4-volt lamps scattered through the hair of the girls, and operated by batteries strapped to their backs. The current was controlled from small push buttons concealed in the hands of the girls. Another striking effect, which made the use of batteries necessary, was obtained by the use of ten individual batteries, each operating one-half-cp 4-volt lamp. In a moonlight scene, with the stage half dark, a "firefly scene" was enacted, in which each man would alternately light his lamp, which he had previously placed on some part of his body, and would extinguish it just as his neighbor endeavored to grasp it in his hand; thus imitating as nearly as possible the catching of a firefly. Directly following this were eight transparent papier maché mandolins, illuminated each by a 16-cp lamp connected to a long black lamp cord, which allowed plenty of freedom to the actors. In this way many in the audience, if not all, were under the impression that these lamps were also operated from storage batteries.

One could write indefinitely of various effects similar to these in which the secondary cell is used. In England, however, in many theatres, the batteries are also employed to carry the load during the daytime, when the only light used is for office work and dressing rooms. This scheme, which is also used on a larger scale in the city lighting plants, has been found to be especially economical in theatres.

Counter E. M. F. in the Arc.

To the Editor of The Electrical World:

Sir—I read with much interest some very able criticisms by Mr. Irving A. Taylor on the counter E. M. F. of the arc, in your issue of September 18, 1897, that has just reached me. It is a pity that he did not encounter in the *Novum Organum* another sentence, advising himself "not to fall into the error which is a blind hurry of judging" an experiment without being acquainted with the complete history of it. If he will favor me by reading my article in the *Electrician* of September 3, 1897, he will see that the positive basis of my conclusion consists of a comparison of the apparent resistances of the arc (volts divided by amperes), when burning and when extinguished (the resistance of a rheostat without self-induction being taken as a term of comparison). The apparent resistance being the same in the two cases it is difficult to see where the E. M. F. could be corrected, and the case is quite different to the proposed motor without inertia, of which the apparent resistance increases with the speed. This objection has been anticipated, for Professor Joubert had favored me some time ago with the same comparison of a motor. Moreover, my conclusions are not absolutely opposed to the existence of a special polarization proportional to the current, and consequently equivalent to a resistance. I feel, however, indebted to Mr. Taylor for having given me, by his courteous remarks, an opportunity for pointing out the principal argument of my conclusions, which I persist in maintaining.

A. Blondel.

Paris.

The Edison Ore Plant.

The New Jersey & Pennsylvania Concentrating Works, of which Mr. Thomas A. Edison is president, has just begun operations at Edison, N. J. The plant is for the reduction of the ores of iron found near that place. The ore is crushed to pass through a No. 14 mesh, and concentrated by passing before three sets of magnets worked in multiple from an 80-volt circuit. The tailings from the last of these contain only 1½ per cent. of iron, while the concentrated product contains 65 per cent. This is formed by pressure into flat cylindrical briquettes for the furnace. The capacity of the plant is 1000 tons of ore per day, shifts of 125 men each being employed. A 93-ton steam shovel handles the ore.

DIGEST OF CURRENT TECHNICAL ELECTRICAL ARTICLES COMPILED FROM FOREIGN AND AMERICAN JOURNALS

BY

CARL HERING

DYNAMOS, MOTORS AND TRANSFORMERS.

Predetermination of Alternators. FISCHER-HINNEN. *Elek. Zeit.*, Oct. 14.—A long article on the predetermination of alternators with reference to the loss of voltage; it is partly mathematical in character, but appears to be of a practical nature, and the calculations are illustrated by numerous examples; the method is a sort of completion of the one devised by Behn-Eschenburg. The method does not admit of being given in abstract. Among other things he states that a first approximation in the calculation of the apparent resistance, when the phase shifting is nearly 90°, can be made by assuming this resistance to be two-thirds of that at short circuit; to determine it for other angles either by calculation or by trial would be very tedious, but as a rule two such trials or calculations can be made, one for short circuit and one for an inductionless load, it being assumed that the apparent resistance between these two points varies according to the straight-line law; these two points can therefore be connected by a straight line. Diagrammatic illustrations of a number of types of machines are given and tables of data containing various factors which are useful in calculations. Assuming that a machine is constructed, he shows how to determine its maximum output independently of the fall of voltage. The "amortisor" of Leblanc is discussed and the data of some machines provided with it are given; this consists essentially of copper bars encircling the magnets, and in these, owing to the armature reaction, a current is generated which is about 180° different from the armature current, and therefore neutralizes part of the lines of force generated by the latter; the objects are to diminish the self-induction and therefore increase the output, and to make the machines more suitable for parallel connections; the former can be done only with single-phase machines. In conclusion he discusses the subject of the maximum allowable fall of voltage, as the output of a machine depends largely on it; the question is what loss of voltage should be considered allowable and how should the classification be made; a general answer is not possible, as it depends on what the machine is to be used for; in the transmission of power with synchronous motors a rather large self-induction is an advantage; the same is true for machines intended for metallurgical processes (electrical furnaces), as it diminishes the risk due to short circuits; the same is true for lighting machines, but it is there counterbalanced by the fact that more attention and regulation will be required; he does not have much confidence in automatic regulation. He compares the fall of voltage in a number of different good machines, and suggests as a maximum limit 15 to 20 per cent., with 0.8 as the cosine of the angle of lag; a smaller fall of voltage could be had, but in general the machine would become too heavy. He also calls attention to the incorrect way in which the output of a machine is generally stated; it is generally given in horse-power or kilowatt, without mentioning the angle of phase shifting for that output. Such statements, therefore, mean nothing, as a machine which will give 100 horse-power on an inductionless circuit may arrive at its maximum at half that current when working on an induction load; the minimum value of the cosine of the angle corresponding to the given output should therefore always be given; a distinction should also be made between watts and volt amperes, the former referring to the product with the cosine of the angle. Confusion also arises when in giving the voltage the effect of the purpose for which the machine is to be used is not considered; a machine for 2000 volts, for instance, if connected with a long circuit of concentric cables must be much better insulated than one for 5000 volts to be used with overhead circuits.

Magnetic Field in Tunnel Armatures. BAILY. Lond. *Elec.*, Oct. 15.—A short article on the mechanical and magnetic force on conductors buried in a magnetic medium, a subject recently brought out again by Mordey and Dobrowolsky. The facts in the case are that the E. M. F. generated in a buried conductor is the same as for an unburied conductor, if the total flux remains the same; that the mechanical drag on the armature remains the same, but that on the conductor is much reduced; and that the eddy currents in the conductor itself are much reduced. He takes the case of an infinitely large field and a conductor completely embedded in the iron, and shows that if the induction is low and the permeability high, the induction in the copper is very small but not zero; as the conductor is in a very weak field the mechanical force acting on it is small; the point of application of the force is not on the conductor nor on the surface of the armature, but is in the iron, principally in the part immediately around the conductor. In explaining the production of the E. M. F. in the conductor, he prefers the definition based on the rate of cutting lines of force rather than the one based on increasing and diminishing the number in the circuit; they both come to this same thing in the end if the conductor forms a close circuit, but of the two definitions the former is the more accurate, as it defines the electric force at each point as well as the total, and specifies the precise place at which the E. M. F. is developed; in calculations sometimes the one and sometimes the other is more convenient, but in most examples it is simpler to consider the cutting of the lines of force; he explains the case of the moving tunnel according to this definition; he states that the action has been admirably pictured by Swinburne, who compared it to the movement of a set of railings as seen through a knot in a pane of glass in a railway or other moving car; he considered it a retrograde step for Dobrowolsky to revert to the idea of increasing or diminishing the number of lines of force passing through the coil. The question of the eddy currents is discussed, and it is shown that they are small, as they are due to the difference in the rate at which the front and back portions cut the lines of force and this rate of change of the field is very small.

Laboratory Di-phase Installation. HANAPPE. *L'Eclairage Elec.*, Oct. 9.—The third of his series of articles on the installation of machinery for instruction in the school at Mons. In this installment he describes the bipolar di-phase current generator, giving the results of calculations and tests, illustrating them fully with numerous curves and diagrams.

LIGHTS AND LIGHTING.

Chaotic Condition of Street Lighting Systems. HUNTER. *Elec. Eng.*, Oct. 7.—A reprint of the paper read at the National Street Lighting Association. He endeavors to show what should be deemed equitable payment for arc lighting, and points out, from statistics, that in the majority of cases the cost is much greater than it should be. He gives some interesting tables of information for each of a number of cities, comparing the costs; Philadelphia, for instance, pays as much as $66 per lamp more than Wilkesbarre, these two being the extreme cases in Pennsylvania; a table is given showing the average candle-power per hour furnished for 1 cent in thirty-two States; the lowest is 367, in Mississippi, the cost of coal being $2 33, and the highest is 791, in Alabama, where the coal costs $1.92; the cities of Massachusetts for a given sum of money receive only 40 per cent. of the amount of light furnished in Pennsylvania; the tables are given to enable city officials in charge of lighting to investigate the cost of lighting with that of other cities. The only important difference in the cost should be that of coal, the consumption of which may be fixed at ten tons per 480-watt, 2000-cp lamp burning 4000 hours per year; in his opinion, a fair price would be $80 per lamp or $60 for the 1200-cp lamp, based on coal at $1 per short ton and overhead construction; where prices are higher it would be well for the municipality to operate its own plant; such a plant is operated by the city of Allegheny (where he is superintendent of public lighting), where it is very successful.

Street Lighting by Contract and by Municipal Ownership. MCVICAR. *Elec. Eng.*, Oct. 7.—An abstract of a paper read before the recent mayors' convention. He quotes briefly from statistics issued by the American Society of Municipal Improvements, stating that 171 cities in the United States contain 187 public and private electric-lighting plants and operate 30,802 arc lamps of 2000 candle-power and 11,572 of 1200 candle-power, besides a large number of incandescent lights, all covering 4893 miles of streets; the lowest price in municipal plants is $30, at Kendallville, Ind. and the highest in Tacoma, $100, for 2000-cp lamps; of those lighted by private contract Cheyenne pays the highest rate, $162, and Minneapolis next with $150; the average rate by contract in twenty-nine of these cities is $106 85; by municipal plants in nine cities $66.26; the price of incandescent lights varies as greatly, the lowest being $9.27 for all-night 32-cp lamps and $25 in New York City, under contract, for 16-cp lamps. He discusses how cities should obtain their light, and to illustrate the possibilities he describes the experience at Des Moines, where several companies are in operation, but were not competing; it was found that a municipal plant could be constructed under very favorable terms, but on account of lawsuits the plant is not yet constructed.

Art in Street Lighting. FOOTE. *Elec. Eng.*, Oct. 7.—An abstract of a paper read before the National Street Lighting Association. He claims that but slight attention has been paid to art in street lighting, and recommends that it would be advantageous for a municipal government to engage a well-paid and well-supported superintendent, whose duty it shall be to lay out the systems of lighting in a scientific way.

Lamps and Their Mechanisms. WATTS. *Elec. Eng.*, Oct. 14.—The con-

clusion of his serial. He continues giving practical hints and criticisms, and ends with a summary of the principal points which he has brought out.

POWER.

Cost of the Generation of Power. Eberle. *Zeit. f. Elektrochemie*, Oct. 5.—A very long, carefully prepared article in which he gives in tables and curves the total cost per hp hour for installations of 200, 400, 600, 800 and 1000 horse-power, both for steam and for gas, for twenty-four hours per day and 365 days, and for eleven hours a day and 300 days per year; the costs are given for seven different prices of coal, including also coke. Various elements in the calculation, including the equations, are all given and they include interest, amortization, attendance, oil, etc. An additional table is given containing a summary of the results, in which the costs are given in pfennig (100 pf. = 1 mark = about 24 cents); the curves are all straight line relations. For water powers similar calculations are not possible; they must be made for each particular case, but these tables will then aid in deciding whether a particular water power will be cheaper than steam or gas.

Electric Light and Refuse Destructors.—Lond. *Elec. Rev.*, Oct. 15.—A short editorial article calling attention to what is being done in other places than Shoreditch, in the rapid development of the combined system of refuse disposal and steam raising for electric lighting. At the pioneer installation at Oldham the boiler capacity is being doubled; Prof. Kennedy has recommended the combined schemes of two important towns; at Ashton-under-Lyme a combined plant is under construction, the Horsfall type of destructor being used; at Lambeth a combined plant is being constructed; at Pembroke a destructor has been ordered; at Swansea, Hackney, Fulham, Gloucester and Weston-super-Mare, plants are under consideration. A short article in another part of that paper on the Shoreditch plant calls attention to the fact that the so-called success at Shoreditch has not yet been demonstrated, although it is believed the system will eventually be found to be a success.

Application of Water Power to Electric Machinery. Field. Lond. *Elec. Eng.*, Oct. 15.—A short article describing how water powers are measured.

Railway Currents for Private Power Purposes.—Elec. Eng., Oct. 14.—A short article favoring such application of railway currents and giving his extended experience with the motors, of which he has installed quite a number; all other things being equal for a 25-hp motor, he would rather use a grounded than a metallic circuit if the voltage is not greater than 600; only one good arrester is then needed; with metallic circuits arcs that are too small to blow the fuse are possible, but this is not the case with a grounded circuit, as the fuse will blow immediately. He never found any trouble with shocks from a 500-volt circuit, standing on wet ground.

Niagara Falls Power Plants. St. Ry. Rev., Oct. 15.—Illustrated description of these power plants.

Water Wheel Government.—Jour. El'ty, Sept.—Illustrated descriptions of a fly wheel and an electrical governor.

TRACTION.

Electric Traction for the London Underground Railway.—Lond. *Elec.*, Oct. 15.—An editorial giving the recommendations of a Board of Trade committee who were to report on the question of what steps could be taken with regard to the ventilation of the tunnel of that steam railway in the interests of the public. They recommend abolishing the locomotives and to adopt electric traction, and that this be done within the next three years.

Stationary Accumulators for Railways. Schroeder. *L'Eclairage Elec.*, Oct. 9.—A long, well-illustrated abstract of the article which was noticed in the *Digest*, Jan. 23, Aug. 21, Sept. 4 and Oct. 9; the illustrations include very good load curves and circuit diagrams.

Motor Carriages.—Elek. Zeit., Oct. 14.—Some data for two German carriages, one driven by heat and the other by electrical energy, both of which recently made an exhibition trip. Both carried five passengers; the data is given by the makers; the total weight with passengers of the Daimler was 1550 kg and of the Kuehlstein (electrical) 2000; the average speeds per hour are 20 and 14, the maximum 26 and 18, respectively; the electric carriage contained thirty accumulators of 250 ampere hours; one charge was sufficient for 70 km; the battery weighs 750 kg and delivers one kw-hour at 53 kg. of battery; comparing the electrical vehicle with one in London (name not given), it is 9 per cent. better than the latter in the weight of the battery.

Bradford.—Lond. *Elec. Eng.*, Oct. 15.—A report concerning the question of railways in that city.

Prevention of Electrolysis. Brown. *Elec. Eng.*, Oct. 14.—An illustrated article in which he describes what he calls the latest method. It first explains the cause of electrolysis and criticises present methods of bonds and joints; he claims that pipes show that the cast-welded joint does not prevent electrolysis. He mentions, but does not describe an instrument which he has designed for making regular inspections of the joints; a careful record should be kept of the electrical condition of each joint; the instrument enables one man to obtain an accurate reading of the amount of current passing through the rail and the exact loss at each joint; the instrument can also be adapted for measuring the current in gas and water pipes without cutting them, and he claims it to be the first successful apparatus with which this can be done; similar instruments are placed on the switchboard at the power house. After detecting the trouble, he shows how it can be remedied; pipes are not injured as long as they are negative to the rails; he describes a method of keeping them negative; it consists in running a very large insulated conductor from the power house to the more distant points where the current formerly passed into the pipes; this conductor is connected to the negative pole of the dynamo; with this, insulated wires make connections with the pipes where they were formerly positive; at the time of heaviest load the distant end of this conductor should be 4 to 6 volts negative to the near end of the track, which is connected to the power house with an ample return circuit; the current flowing on the pipes is therefore reduced to a minimum. The heavy conductors referred to were in Newark made of old rails, the ends of which are connected by plastic bonds, the box in which they are being filled with a liquid insulating compound; the cost is about one-sixth that of a copper line.

High-Speed Electric Railroading. Tesla. *Elec. Eng.*, Oct. 14.—Extracts from a recent interview in a New York journal. He seems to refer to the use of alternating currents and considers the idea not only practical but easy of perfection; the question of speed will be greatly controlled by the track and running gear, which, when properly constructed, will permit speeds of 150 to 200 miles an hour, certainly 100 with safety; the popular impression that such speeds are too great amounts to nothing; balloonists have gone 150 miles an hour; the human frame can stand such speeds just as easily as half the amount.

High-Speed Road. Roberts. *Elec. Eng.*, Oct. 14.—An illustrated description of the line from Lorain to Cleveland, 18.5 miles long; the cars contain four motors of 50 horse-power each and they are arranged for very rapid acceleration; the average speed is 30 miles per hour and the maximum 50.

Prevention of Accidents. Cooper. *El'ty*, Oct. 6: *St. Ry. Jour.*, Oct.—A reprint of a New York State Street Railway Association paper. He describes what he considers the best methods for preventing accidents on street railways; the chief cause is directly or indirectly the human element, and he therefore believes the best method to prevent accidents is to have good, well-paid, well-cared-for men who are watched and disciplined.

Advantages of a Car-Mileage Record. Nicholl. *West. Elec.*, Oct. 9; *St. Ry. Jour.*, Oct.—A reprint of a short paper read before the New York State Street Railway Association. He believes that the subject of mileage is not receiving the attention it should; the mileage is the chief, and in many cases the best and only basis on which to figure statistics with reference to earnings, traffic and expenses, as it brings every item down to a standard; he uses the system on his road, where it works to perfection; the method adopted by that road is explained in detail; the road having been carefully surveyed and the lengths determined, each motorman makes a report of the number of trips, and from these trip cards the mileage for each car is kept; monthly mileage statements are also kept.

The Electric Street Railway Repair Shops. Dunning. *West. Elec.*, Oct. 9; *Elec. Rev.*, Oct. 6; *St. Ry. Jour.*, Oct.—A reprint of a paper read at the New York State Street Railway Association. He describes and gives a list of the tools of a typical shop for a road operating from 100 to 400 cars.

Street Car Wheels.—West. Elec., Sept. 25; *Elec. Eng.*, Sept. 30; *St. Ry. Jour.*, Oct.—A. reprint of a New York State Street Railway Association paper. He (a maker of wheels) shows the gradual evolution of car wheels and concludes that for a standard 33-inch wheel, 380 to 400 pounds on 2.25 and 2.5 inch treads is not too much for the present service. He also urges the adoption of a standard length of axle and standard boxes.

Low Joints and How to Prevent Them. Allen. *West. Elec.*, Sept. 25; *St. Ry. Jour.*, Oct.—A reprint of a New York State Street Railway Association paper. He describes his experience in Syracuse, where no trouble arose with the construction which he describes; the ties at the joint are laid to form what is known as the three-tie joint; the whole track structure, however, must also be considered.

Tramway Situation in Vienna. Ziffer. *St. Ry. Jour.*, Oct.—A short account of the situation in Vienna, Austria, describing the disputes and referring to the lines which are to be completed and opened by May next year.

Accidents. Clark. *St. Ry. Jour.*, Oct.—An article containing interesting statistics of accidents in New York City, comparing those due to street railways with those due to other causes.

Making Efficiency Tests of Street-Railway Motors. Porter. *St. Ry. Rev.*, Oct. 15.—A short, illustrated article describing some methods for making tests of motors.

Testing Car.—St. Ry. Rev., Oct. 15.—A brief illustrated description of the test and drill car used on a line in St. Louis.

Electrically Operated Cable Line. Grover. *St. Ry. Rev.*, Oct. 15.—A brief, illustrated description of a line in Kansas City in which the cable is driven by an electric motor.

Street Railways of Niagara.—St. Ry. Rev., Oct. 15.—A long, profusely illustrated descriptive article.

Binghamton. GARDNER. *Elec. Eng.*, Oct. 14.—An illustrated description of the railway system.

Tampa.—St. Ry. Rev., Oct. 15.—A brief, illustrated description of the railway in that city, in which the power is derived from a water fall.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Free Supply of Incandescent Lamps.—Lond. *Engineering*, Oct. 14.—The conclusion of the discussion of Gibbings' paper. Booth has used the system at Preston; he also found that it was very difficult to induce people to renew their lamps before the system was introduced; he, however, supplies lamps in exchange for the old ones, a coupon being attached to the quarterly account entitling the holder to a new 16-cp lamp in exchange for an old one for every fifty-six units used; by taking back the old lamps he is sure that the new ones will be used; the coupon may be presented at any time; a liberal discount has always been allowed for early payments, and therefore this was not made a qualification for receiving new lamps; his experience is that nothing better could have been done to insure the satisfaction at less cost to the station, and supplying the best lamps without charge. Quinn did not favor the system, as he claims that a station supplies electric energy and not light; he suggests selling good lamps at cost price. Snell admits the advantage of a consumer using guaranteed lamps, nevertheless he prefers the maximum demand system; he objects to the additional clerical work in the Gibbings system, and he believes customers would prefer a rebate. Steinitz praises the system, but thought there were grave objections to it; the number of lamps to be handled in a large station would be enormous, and would require a special staff for testing. Wright recommended a modification by giving a discount of 5 per cent. within three weeks, either in lamps or cash, the lamps being supplied at cost price and guaranteed by the company. He thinks this is fairer to all consumers, as the benefit is irrespective of the nature of the demand, and does not require extra meters where arc lights are used. Gibbings, in his reply, claims that too many side issues were raised in the discussion; the system has been productive of excellent results in Bradford; the total cost of the lamps is insignificant, so that it cannot be claimed that one consumer is being treated better than another; what the station supplies is really light, and it is therefore the duty of the station to see that the best lamps are used.

Bradford.—Lond. *Elec.*, Oct. 15; *Elec. Eng.*, Oct. 15; *Lightning*, Oct. 14.—An illustrated description of the new central station.

Zurich.—Lond. *Elec. Eng.*, Oct. 8.—Abstracts of data from the annual report of the municipal works.

Cheltenham.—Lond. *Elec. Eng.*, Oct. 15.—A summary of the accounts of this station.

Municipal Ownership in Santa Clara. QUINN. *Jour. El'ty*, Sept.—A short article describing this plant, which is operated on business principles, has fulfilled all expectations and is more than self-supporting.

Municipal Ownership. WRIGHT. *Elec. Eng'ing*, Oct. 15.—The beginning of a long article on the powers and privileges of corporations versus the rights of the people.

Calculation of a Sinking Fund. MOGENSEN. *Eng. News*, Oct. 21.—An abstract of an article from the *Technograph* in which he gives a table of the annual payments to a sinking fund necessary to accumulate $1 at the end of a given number of years, the table being used for calculating the sinking fund item in the calculation of the maintenance of engineering structures.

WIRES, WIRING AND CONDUITS.

Construction of Transmission Lines. EASTWOOD. *Jour. El'ty*, Sept.—A reprint of a Pacific Coast Electrical Transmission Association paper. He calls attention to the importance of the proper construction of the pole line, which generally receives less consideration than any other part of the plant, which he believes is due to the fact that the literature on the subject is very meagre; the tendency is to follow the loose methods and bad workmanship of the earlier constructions. He discusses the subject under the head of location, materials and construction; the best general location is a straight line between the points; the danger of malicious interruption is largely decreased by having the lines remote from the public highways; over rolling or hilly ground it is best to keep as straight as possible; all horizontal angles should be avoided. The selection of the best material is of vital importance; sap-wood of any variety is absolutely worthless in its lasting qualities in the ground; he recommends sawed redwood poles; the use of tar on the butts is of doubtful value, as the wood is generally green; a better plan is to set the pole, and after a few years dig away two feet of the earth and apply the tar hot during the dry season; the decay is greatest at or near the surface; it is almost impossible to locate a weak or decaying pole before the breakdown; cross arms should be made of Oregon pine, 4 x 5, rounded on the upper side; some further details are given. The question of the insulators is discussed in a general way; he recommends bolted pins, as that enables the insulators to be screwed down tight after being put in alignment.

Insulators for High-Voltage Lines. SEARS. *Jour. El'ty*, Sept.—A reprint of a short Pacific Coast Electrical Transmission Association paper. As bare wire is universally used the insulation is due entirely to the supporting insulators; he enumerates the necessary qualities of these; he considers that porcelain is superior in strength, toughness and hygroscopic properties; glass insulators, when struck by the unscrupulous marksman, fly to pieces, while a porcelain insulator merely chips. The term porcelain is often used in a loose sense; true porcelain is absolutely vitreous and homogeneous throughout, the body possessing the same insulating properties as the glaze; much of what is called porcelain is not of this kind, the body of the ware being porous, the insulation being due to the glaze; these he says are worse than useless for high voltages on outside work. He makes some quotations on this subject from standard works. Insulators are now made which will not absorb moisture even when unglazed, the purpose of the glaze being merely to make a smooth, glossy surface; a salt-water test of 40,000 volts will detect any defects, and insulators so tested may be relied upon for the most severe conditions. It is poor economy to adopt a small insulator on account of a slight saving in first cost.

Insulators for Electric Power Transmission. SHOCH. *Jour. El'ty*, Sept.—A reprint of a short Pacific Coast Elect. Transmission Association paper. He calls attention to the fact that the climatic conditions must be considered in every case; where snow and ice are prevalent for four or five months it becomes a serious problem, as in those cases in California where the source of power is above the snow line. Some experiences of the line between Folsom and Sacramento, 22.5 miles long, are described; the triple vertical petticoat insulators gave most of the trouble at first, and the triple flare petticoat type gave most of the trouble during the second year; in most cases the pin was burned, and almost always at the lower edge of the inner petticoat where the glazing had been removed in baking; he shows that it is not so much the shape of the insulator as it is the manner in which it is made; where the glazing was burned off the test showed that the material was porous; where the bare copper wires were attached the glazing was worn off; this shows that an extra heavy glazed surface is required, and as perfect homogeneity as possible; the cost of the insulators is a very important factor, but a greater cost may be offset by better insulating properties; he believes a certain insulator in which the outer shell is of china and the centre of glass or china meets all the requirements for high insulation.

Line Insulation of 16,000 Volts. VAN NORDEN. *Jour. El'ty.*, Sept.—A reprint of a short paper read before the Pacific Coast Elect. Transmission Association. A brief account of the experience on the lines of the Central California Electric Company, about 28 miles long. There are three wires, which are spiralled every mile; the voltage is 16,000; the insulators are of porcelain and have three petticoats, the middle one of which is longer than the other two; the wires come within 8 inches of each other in places. Only three kinds of annoyance developed; some of the petticoats have been shot off by sportsmen; a few of them split off and broke under the electrical stress; a number of poles with defective insulators were burned owing to the presence of sap; although about a dozen poles were thus destroyed it seldom caused serious disarrangement or interruption of the service; no pins were burned by the effect of rain drops or spider webs, which is attributed to the greater length of the middle petticoat; with the aid of the portable telephone a defective insulator can be exchanged with a shutdown of five to nine minutes; they are convinced that 30,000 volts can be easily used with the present insulators, provided that the pins are of approved material and that both arms and pins are boiled in paraffine and then soaked with insulating paint; the poles should be of red wood.

Modern Construction and Maintenance of Electric Lines. BROPHY. *Elec. Eng.*, Oct. 7.—A long abstract of a paper read before the recent mayors' convention. The paper seems to have reference only to the construction of lines for fire and police service; it is acknowledged that the underground system for any form of electrical energy, except for long-distance telephone, is the best; the insulation can be kept at 1000 to 6000 megohms per mile, a figure which cannot be approached by overhead lines; the system should be underground throughout, and not a mongrel one; he describes in the original paper the drawing in and the solid system, and recommends the latter for this kind of service, as it is much less expensive. The insulation of overhead lines is only a pretence; the insulation resistance should not be less than 15 to 20 megohms per mile, and yet it rarely reaches from 2 to 5; it would be better to use wires without covering and have it understood that they are dangerous, or, better still, to insulate them and cover them with lead, and then the same high grade of insulation can be maintained as for underground wires. He discusses line construction as it exists; it is false economy to claim the top of the poles for such circuits; roof construction should be avoided, because it is not easily controlled and cannot be readily inspected; bare uninsulated loops should be avoided; copper wire well insulated and protected from mechanical injury is the best in the end; the present form of line construction he considers a relic of barbarism.

ELECTRO-PHYSICS AND MAGNETISM.

Röntgen Rays.—Lond. *Elec. Rev.*, Oct. 15.—A number of brief abstracts from various sources. Gaedicke experimented with two ordinary dry plates, one of which was rendered isochromatic by dipping in erythrosine

of silver; these were covered with screens of various fluorescent materials; he found that the orthochromatic plate showed much stronger action than the ordinary without the screen and that "they increase the action of all the screens" (?); he concludes that for X-rays only erythro-silver plates should be used; the fluoride of ammonia and uranium reduces the action of the rays to one-half on the ordinary plate and to two-thirds on the other, and ought, therefore, not to be used; the calcium tungstate of one manufacture doubles the action and of another quadruples it on an ordinary plate, while the action on the other plate is still greater; the platino-cyanide screen diminished the effect on the ordinary plate, reducing it by one half. Livermore, in another article, describes a similar series of experiments, agreeing with these in showing that the most efficient was the isochromatic plate with the platino-cyanide screen, but he obtained entirely different effects with the fluoride of uranium and ammonia, as he obtained almost as good effects; isochromatic plates are, in general, superior for this work. Vosmaer and Ortt suggest a theory of Röntgen rays; they assume that the cathode rays are electrified particles which lose their charges when they strike the positively electrified anode; if the charge on the anode is just sufficient to neutralize this, then pure Röntgen rays are produced; they believe that these particles can pass through the walls of the tube. Porter tested, by experiments, whether the Röntgen image of an aluminum plate was enlarged or contracted when the plate was electrified, but he failed to observe any effects. Wimshurst, who used an influence machine, coats the cathode end of the tube with tinfoil, leaving about one-quarter inch between the tinfoil and the cathode terminal of the tube; such a tube will illuminate with a much shorter spark and with more certainty, the life of the tube being also prolonged.

Chemical Constitution and the Absorption of X-rays. Gladstone and Hibbard. Lond. *Elec. Eng.*, Oct. 8.—A brief abtract of a British Association paper. They estimated the absorption in various substances by means of a photometer; when thus examining an aluminium scale which had been used for similar purposes they found that the rays absorbed by different thicknesses varied nearly in a logarithmical ratio; the order of absorption of a few compounds is given; experiments made to determine whether an element has the same absorption in the metallic and combined condition, showed that in the case of copper the metal absorbed more than its oxides; the change of atomicity of a metal does not seem to be followed by any electrically marked difference in absorption; the absorption of carbon when combined with hydrogen differs little from that of charcoal or graphite.

Experimental Researches on Electro-Chemical Actinometers. Rigollot. *Jour. de Physique*, Oct., translated in abstract in the Lond. *Elec.*, Oct. 15.—When two metallic sheets are placed in a liquid, one illuminated and the other in the dark, a difference of potential is observed; in the present article he describes experiments and studied the action of white light and of the various constituent radiations upon other metallic compounds. His experiments show clearly the increase, which is sometimes considerable, of the E. M. F. which takes place when an illuminated strip has been previously plunged in a colored solution; he also points out some of the practical applications of the phenomena. In all actinometers the E. M. F. due to illumination ceases instantaneously with the illumination; actinometers are excluded from commercial photometry, as each instrument responds only to particular radiations; they may be used to advantage, however, for the comparisons of two sources of light of different color.

Molecular Theory of Conductors. Silberstein. *Elektrochem. Zeit.*, Oct.—In a previous article (see *Digest*, Jan. 2) he described his molecular theory of conductors of the first class, but he since found that his theory applies also, and directly, to dielectrics and the so-called semi conductors; in the present article he gives a brief explanation of his theory applied in general to all of these. According to his theory all masses consist of "adielectric" particles or molecules which are distributed in the light ether and that as far as the electromagnetic phenomena are concerned, they form spaces in the ether; Ohm's and Jule's law for instance are the mean results of a rapid succession of discharges between the "adielectric" molecules.

Hall Effect in Liquids. Florio. *Nuovo Cimento*, Aug., noticed briefly in the Lond. *Elec.*, Oct. 15.—The existence of this effect in liquids has been a subject of controversy; the present author criticises Bagard's method from a theoretical point of view and claims that the effects observed are due to secondary actions.

Explanation of Bagard's Hall Effect. Chiavassa. *Elettricista*, No. 10, abstracted briefly in the Lond. *Elec.*, Oct. 15.—He investigated the Hall effect in liquids, using Bagard's apparatus and succeeded in eliminating the sources of error, thus reducing the apparent effect to the vanishing point.

Electric Endosmose. Villemontee. *L'Eclairage Elec.*, Oct. 9.—The beginning of an article which appears to be a sort of treatise on this subject; the present portion begins with a historical treatment and continues with a description of the chemical and mechanical phenomena.

Secondary Waves in Dielectrics. Righi. *Nuovo Cimento*, Aug.; noticed briefly in the Lond. *Elec.*, Oct. 15.—An insulator immersed in a dielectric traversed by electromagnetic waves, and having a dielectric constant different from that of the medium, becomes the centre of secondary waves, which differ from those of a resonator in that the insulator responds to all the waves, while a resonator responds only to those of a definite period; he shows how to avoid the disturbance produced by bodies.

Electric Waves in Selenite. Righi. *Nuovo Cimento*, Aug.; abstracted briefly in the Lond. *Elec.*, Aug. 15.—Descriptions of experiments confirming his former results.

Electric Waves. Mazzotto. *Nuovo Cimento*, Sept.; abstracted briefly in the Lond. *Elec.*, Oct. 15.—Two articles, one describing his method of investigating complex waves, applying it to the Blondlot wire system. In the second article he endeavors to find a formula expressing the dependence of the wave length of waves emitted by a Lecher system upon the lengths of the wire appendages.

Effect of the Exciter on Electric Waves. Apt. *L'Eclairage Elec.*, Oct. 9.—An abstract of the article which was noticed in the *Digest*, July 17. He discusses the effect of the exciter on the form and intensity of the electric oscillations in the Lecher system.

ELECTRO-CHEMISTRY AND BATTERIES.

Accumulator Construction. FitzGerald. Lond. *Elec. Eng.*, Oct. 8 and 15.—A continuation of his serial. He discusses the subject of the weight of active material per ampere hour; the theoretical ampere-hour equivalent of the metallic lead contained in the active material on either plate is 59.39 grains, or 0.135 oz., but in practice only a portion of this is active; in practice he has found that from 0.52 oz. to 0.80 oz. of spongy lead, according to the rate of discharge, thickness and density, is required on the spongy lead plate to give one ampere hour; Reckenzaun found 0.58; on the peroxide plate the author found that from 0.53 oz to 0.86 oz, of metallic lead when converted into peroxide will yield an ampere hour; Reckenzaun obtained 0.58 of peroxide as the equivalent; Sellon found 0.53 and even 0.34 oz.; in the author's values the voltage was not run down below 1.85; the weight of metallic lead in a given weight of peroxide is obtained by multiplying the latter by 0.867; the corresponding equivalents for the other oxides are also given. A rough practical rule, in which the error is generally on the safe side, is to allow 0.53 oz. of metallic lead in the active material of each plate for every ampere hour for a slow discharge rate, 0.60 for a five-hour discharge rate, 0.70 for a three-hour rate, and 1 oz. for a one-hour rate; he discusses and criticises the straight-line law involved in this proportion; he points out the importance of increasing the service for increased rates, and shows that there is no need of increasing the weight of the active material per unit area in order to get a greater capacity for the rapid rates, but that on the contrary it may often be reduced to advantage. In the issue of October 15 he discusses the question of the permissible thickness of the layer of active material, pointing out the advantages of the Planté type; also the question of the local action on the peroxide plate, showing that the lead frame of that plate if exposed will immediately be covered with sulphate due to local action, and that this will protect it.

Storage Batteries. Wade. Lond. *Elec.*, Oct. 15.—A continuation of his serial; he discusses and illustrates various forms of grid supports.

Gold, Zinc and Electrolysis. Andreoli. *Elektrochem. Zeit.*, Oct.—A German reprint of the French article which was noticed in the *Digest*, June 5 and 19.

The Effect of Electrometallurgy on the Constitution of Some Materials. Duerre. *Elektrochem. Zeit.*, Oct.—A short article in which he calls attention to some of the characteristics of metals reduced or refined by electrolytic processes.

Division of the Current Over Different Ions in a Solution. Stackelberg. *Zeit. Phys. Chem.*, 22, p. 493, mentioned in *Zeit. f. Elektrochemie*, Oct. 5.—A mathematical treatise on solutions with several cations and anions of different migration velocities.

Determination of State of Ionization. Macgregor. Lond. *Elec. Eng.*, Oct. 15.—A reprint of a British Association paper. It deals with dilute aqueous solutions containing two electrolytes.

Chemical Action of Electric Oscillations. Hemptinne. *Zeit. Phys. Chem.*, 22, p. 358, and 23, p. 483; noticed briefly in the *Zeit. f. Elektrochemie*, Oct. 5.—He made researches with the decomposition of gases in a field of electrical oscillations such as is generated by a Lecher or Tesla system, and with the dependence on pressure, temperature and wave length.

Theory of Electrolysis. Nernst. *Zeit. Phys. Chem.*, 22, p. 539; reprinted in the *Zeit. f. Elektrochemie*, Oct. 5.—A short article, being a continuation of his article on contact electricity. He discusses the chemical equilibrium, the electromotive action and the electrolytic separation of mixtures of metals; he believes that this theory is of use in the study of alloys and their electrolytic production.

Theory of Electrolytic Dissociation. Carrara. *Zeit. f. Elektrochemie*, Oct. 5.—A long abstract from the Italian; it refers to the theory applied to other solvents than water, aceton being the solvent considered in the present portion.

Number of Ions in Ammonia-Cobalt Combinations. Petersen. *Zeit. f. Elektrochemie*, Oct. 5.—An abstract of an article from the *Zeit. Phys. Chem.*, 22, p. 410.

Nitrogen Acids. Baur. *Zeit. Phys. Chem.*, 23, p. 409; noticed briefly in

the *Zeit. f. Elektrochemie*, Oct. 5.—An article on the determination of the affinities and the heats of dissociation of some nitrogen acids.

UNITS, MEASUREMENTS AND INSTRUMENTS.

New Method of Localizing Total Breaks in Submarine Cables. SCHAEFER. Lond. *Elec.*, Oct. 15.—A very long article of special interest to those working with submarine cables; he gives several new laws covering the relations between the area, potential and resistance of broken ends of cables in sea water; he describes the Kennelly 2-current polarization zero method and the 3-current instrument zero method, and carries the investigations further on these lines, finding that the resistance to a constant current varies inversely as the 4.3th root of the exposed area, and that the resistance to a constant area varies inversely as the 1.3th root of the current; Kennelly's laws of the reverse square roots are approximately correct up to certain limits of current; Schaefer's new laws extend this limit up to 50 milliamperes per square centimeter of exposure, above which figure the resistance variation departs from the above mentioned law. Schaefer's method consists of a two-current test taken to the instrument zero, the resistance effect of the polarization current being calculated from its E. M. F. in millivolts as measured through a high resistance, and from the current flowing to line in milliamperes, the correction being additive or subtractive, according as the current acts with or in opposition to the testing battery; it is a zero method applicable to any length of cable and is a test which can be made with a remarkable degree of accuracy even by unskilled observers. In an appendix he describes how under certain circumstances this break test may be applied to the localization of a fault with very satisfactory results; the method disposes entirely with the necessity of knowing the absolute currents used by the terminals.

Heat and Cold Regulator. RICHTER. *Elektrochem. Zeit.*, Oct.—A brief, illustrated description of his apparatus, which will enable a very constant temperature to be kept, as is often required in chemical and electrolytic researches. It is based on the principle of an air pyrometer, the air pressure in which acts on a column of mercury; the apparatus is said to be very cheap.

Recording Electric Currents by an Electrolytic Process—Elektrochem. Zeit., Oct.—A portion of the article which was noticed in the *Digest*, Aug. 28, and which was inadvertently omitted in the journal in which the original was published.

Board of Trade Standardizing Laboratory.—Lond. *Elec.* and *Elec. Eng.*, Oct. 15.—A reprint of a Board of Trade circular, stating that that body is now prepared to examine and test electrical instruments; a table of the fees charged is included.

Use of Rapid Oscillations in the Wheatstone Bridge. NERNST. *L'Eclairage Elec.*, Oct. 9.—A long abstract of the article noticed in the *Digest*, June 19.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Wireless Telegraphy. MINCHIN. Lond. *Elec.* and *Elec. Rev.*, Oct. 15.—A short communication criticising the claim of Marconi of having discovered the use of a wire connected with one pole of an instrument used for receiving impulses from a Hertz oscillator; he refers to early experiments made by him published in 1887 and 1891. The claim of Marconi to the sole use of the wire connected either to the receiver or the oscillator is claimed to be absurd.

Telegraphy without Wires.—A European dispatch states that Marconi's recent experiments in Berlin have been extraordinarily successful; they were performed with the aid of military balloons; messages were sent between two stations 13 miles apart, in spite of unusual atmospheric conditions.

Accumulators in Telegraphy and Telephony.—Zeit. fuer Elek., Oct. 1.—A short account giving some data for the installations in Paris, Berlin, Hamburg, Stuttgart and Rome. Most of the makers guarantee the accumulators for three to five years at two to five charges per year; in their voltage three cells replace nine gravity cells.

Telegraph System. POMEY. *L'Eclairage Elec.*, Oct. 2.—A description, with numerous diagrams, of a system in which three stations are connected together in such a way that each can call either of the other two without calling the third, and can use the line for telegraphy or telephony; the system has been in use with satisfactory results on some French lines for several years.

Siemens & Halske Telegraph Cables.—Lond. *Elec. Rev.*, Oct. 15.—Illustrated descriptions of various types constructed by that firm at present.

Rapid Telegraphy. SUMMERS. *Elec. Eng'ing*, Oct. 15.—An editorial which is unfavorable toward rapid systems of telegraphy. He claims that the failure of efforts in this direction is due to the requirements of the service and not to the failure of the instruments; the whole train of modern telegraphy is toward subdivision and not concentration; a number of alleged erroneous views expressed in the recent papers by Crehore and Squier are pointed out; the arguments regarding cheapness are discussed and some figures are given, which tend to show that the labor of preparing the messages is 75 per cent. of the cost, and that the saving of the line wire is, therefore, but a small portion; unless the labor cost could be diminished, a system which utilizes the wire better could not bring about a reduction of over 25 per cent.; moreover, the multiple wires permit of numerous subdivision, and delays to one wire interrupt only a small portion of the business; he concludes that we must abandon the idea that a rapid system designed for wire economy alone will solve any of the difficulties met with at present, save for operating expense.

Telephone Patents. MAXWELL. *Elec. Eng'ing*, Oct. 15.—A short article on "The Gullibility of Investors," showing how the Bell patents cover the field, and citing, as an instance, the opposition plant at Sing Sing, N. Y.

Balancing Duplex and Quadruplex Apparatus. SKIRROW. *Teleg. Age*, Oct. 16.—Brief, practical directions for balancing.

MISCELLANEOUS.

Lightning Rods. KOCH. *Elek. Zeit.*, Oct. 14.—A short article supplementary to the one which was abstracted in the *Digest*, May 15. He gives the results of observations during the past storm season, showing the great variations in resistance of a discontinuous lightning rod; the data is given for several storms, showing that before the storm the resistance was practically infinite, and that it became finite and gradually quite low as the storm approached; when it receded again the resistance increased; the changes took place at the moment of the discharge and before the thunder could be heard; he thinks that with most of the lightning discharges there is a diminution in the resistance of discontinuous conductors; his observations show that such discontinuous conductors are to most lightning discharges as the laboratory coherer is to the discharge of a Leyden jar; he thinks his experiments prove with great probability that the lightning discharge is oscillatory. He follows this with a suggestion which he made a number of years ago to protect whole groups of buildings by running wires over the tops of the houses and connecting these wires, say between every two houses, with the ground; all large masses of metal should be connected with this system of wires; the cost for a whole village would be relatively slight; in an installation in which the three-wire system is used this system of protection could be had without additional cost by running the bare neutral wire over the tops of the houses instead of parallel with the two outer wires.

Scientific Ballooning and the Higher Strata of the Atmosphere.—Lond. *Engineering*, Oct. 15.—The beginning of an editorial article, giving data.

Sterilization of Impure Water by Ozone. ANDREOLI. Lond. *Elec. Rev.*, Oct. 15.—The progress in the construction and working of ozone generators has lately been such that ozone can now be produced in large quantities continuously, and the industrial applications of ozone can therefore be carried on now at a relatively low cost and on a large scale; impure water can be rendered wholesome and drinkable by means of ozone, which in the presence of water acts as a very powerful bactericide; solubility or insolubility of ozone in water has nothing to do with the destruction of the microbes; for sterilizing water the ozone must be supplied in a continuous manner and in adequate amounts; it is not sufficient to blow ozone through the water; sterilizing water is an art and a very difficult one. He can now guarantee a minimum of 100 grams per hp hour; 2,000,000 gallons of water could therefore be disinfected every hour with a 1000-hp installation; he does not pretend that ozone can be utilized at present in large cities, but that the time will soon come; meanwhile it can be tried in small towns; he is now making experiments, the results of which he will publish in that journal.

Electrically Heated Pressing Iron. WIECZOREK. *L'Eclairage Elec.*, Oct. 9.—An illustrated description of the one referred to in the *Digest*, July 24, in which the heat is produced by an arc formed inside of the iron.

Muscular Electricity. WRIGHT. Lond. *Elec. Rev.*, Oct. 15.—The first part of an article describing experiments for studying the electrical phenomena attending muscular contraction.

Siemens & Halske Jubilee. HOWE. *Elek. Zeit.*, Oct. 14.—An article describing the development of this German firm since its organization on the 12th of October, 1847, the occasion being the celebration of the fiftieth anniversary.

Permanent Aerial Weather Stations. MCTIGHE. *Elec. Rev.*, Oct. 20.—A short communication referring to the forecasting of weather, pointing out the defects of the present system, which he claims are due to the want of knowledge of what is going on in the atmosphere at high elevations, and claiming that the forecasting can never be reliable until there is a proper apparatus for studying the conditions high above the earth's surface; he recommends making these studies with instruments suspended at a height of about a mile by means of an anchored balloon of moderate size, which is sustained continuously by being supplied with gas as required through a small tube in the anchor rope; a spherical balloon 12 feet in diameter would have a lifting power of 60 pounds. A note in the *Eng. News*, Oct. 21, states that the highest kite flying on record was that at the Blue Hill Observatory, Massachusetts, on Oct. 9; the kite with instruments attached attached reached a height of 10,900 feet above the hilltop, which is only 60 feet short of two miles above the sea level.

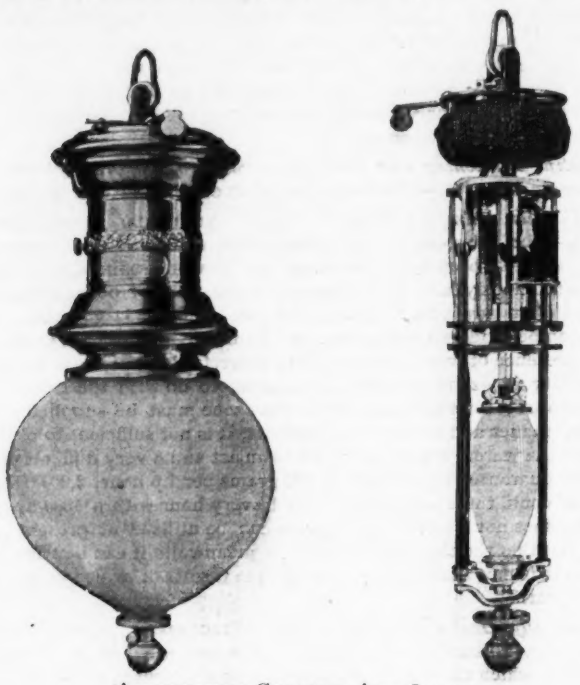
National Street Lighting Association Convention.—Prog. Age., Oct. 15.—A very full account of the proceedings, with reprints of the papers and discussions; the report is quite long and is to be continued. Some of the papers have already been noticed in the *Digest*. They include one by Hopewell on electric wires, in which he refers to their supports from a mechanical and electrical standpoint.

Mayor's Convention.—Prog. Age., Oct. 15.—A reprint of a stenographic report of the proceedings of this convention including reprints of the papers, some of which have been noticed before in the *Digest;* the report is very long, and is to be continued; the discussions appear to be given in full.

American Electrotherapeutic Association —Elec. Eng., Oct. 7.—A brief account of the proceeding of the recent meeting in Harrisburg; a list of the papers is given, but no abstracts.

Enclosed Alternating-Current Arc Lamp.

In the new alternating-current arc lamp manufactured by the General Electric Company the objectionable characteristics of most lamps of this class—low economy and noisy, uncertain action—have, it is stated, been overcome. It operates on constant-potential alternating circuits with higher economy and greatly diminished noise. The principles of the enclosed-arc lamp and the economical advantages of its use over open-arc lamps are familiar, but as between open and enclosed alternating-arc lamps, it is not so generally known that a greater difference in economy in favor of the enclosed lamp is shown than in the same comparison between open and enclosed direct-current arc lamps. In the G. E. alternating-current enclosed-arc lamp one pair of carbons will last between sixty and seventy hours, and effect a saving of about 80 per cent. in the cost of lamp carbons; a larger arc is maintained; the light is emitted without obstruction; and its protection from currents of air and any sudden action of the mechanism allows the light to become and remain steady.



Alternating-Current Arc Lamp.

The mechanism is simple, the number of moving parts being reduced to a minimum, and its action is quick and positive. A special adjusting spring keeps the current constant whatever the position of the core. The mechanism is supported on a frame with a double base, which gives a dead-air space and provides protection for the mechanism from the heat of the arc.

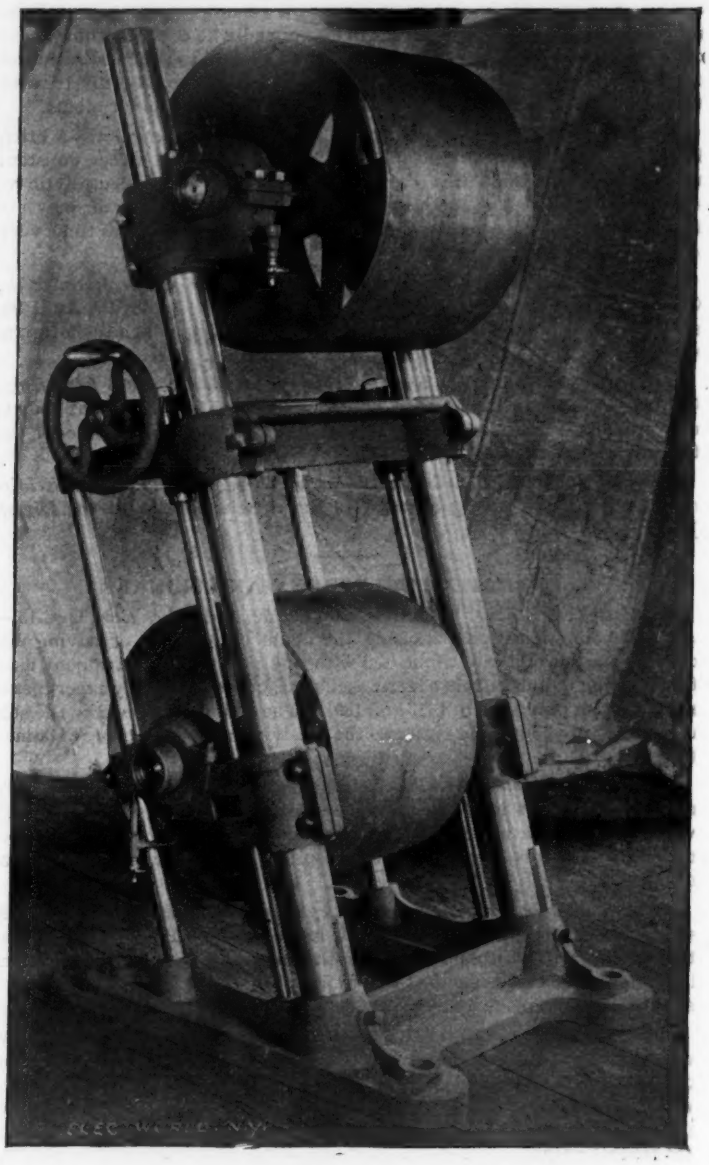
This lamp operates on circuits of 100 to 120 volts and 60 or 125 cycles frequency. About 70 volts are required at the terminals of the arc, the nominal current being 5.5 to 6 amperes. An inductive resistance contained within the ornamental top of the lamp, and connected in series with the arc, gives the necessary reduction in the voltage, and, preventing sudden changes in current, checks any unsteadiness of the light. The half-inch carbons used are 9 1-2 inches long in the upper holder and 6 inches in the lower—one cored, the other solid. They are proportioned to allow the piece left in the upper holder after one run to be used in the lower holder for the next. The inner globe is supported by a self-locking device. To lower the globe, the lower ball is unscrewed, the globe raised slightly and released by turning the release-screws on the side of the cylinder. To replace it, the globe is simply raised until it locks, when it is tightened by screwing up the lower ball.

This lamp is 28 1-4 inches in length and 31 1-8 pounds in weight. It is artistic in its proportions, and is judiciously ornamented. For interior illumination, *i. e.*, for halls, large stores, restaurants, theatres, public buildings, the casing of the lamp is finished in ground brass or black enamel. For outside use a weather-proof casing is furnished.

The L. P. & D. Transmitter.

A new form of belt transmission apparatus has been brought out by the L. P. & D. Transmitter Company, Montpelier, Vt. This company has succeeded to the business of the Perry Manufacturing Company, whose transmitters are well known and widely used for electric-dynamo driving.

The general purpose of the transmitter is to enable the dynamo or driven member, whatever its nature, to be placed near the driving pulley, instead of at the distance necessary with plain belt driving. This object is attained by the application of idle pulleys in such a manner that a large arc of contact is obtained on the smaller pulley, thus preventing the slip which would necessarily take place were two pulleys of different diameters connected directly by a belt. The new form of transmitter, which is shown in the accompanying illustration, has several advantages over the old. Chief of these is the belt tightening mechanism which is self-contained in the transmitter, rendering the use of a sliding base for the driven machine unnecessary. The new transmitter has two idlers, one of which is fixed, the other adjustable, these two idlers holding the belt in such a way that it remains in contact with the smaller pulley for almost a complete circumference. With this machine the belt-driven dynamo may be placed immediately adjacent to its driven engine, instead of being removed some 20 feet or more therefrom. The lower idler is moved up or down by a worm gear and screw which is operated by the hand wheel, shown in the illustration.



L. P. & D. Transmitter.

NEWS OF THE WEEK

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, October 25, 1897

ELECTRICAL STOCKS.—The market for this class of securities during the past week exhibited a little more strength than was recorded the week previous. There are some advances in prices, and they outnumber the losses. Among the most prominent stocks which closed the week with advanced prices may be noted Edison Electric Illuminating of New York, Electric Storage Battery, common and preferred, and General Electric, both issues. Westinghouse issues show fractional declines. General Electric during the week reached 35¾, the highest point, and 33⅛, the lowest, closing at 34⅛. This represents a net advance of ¼ point. The total number of General Electric shares sold during the week was 6989. In the electrical bond list con. 5's of the Edison Illuminating Company of New York receded about 1 point.

TELEGRAPH AND TELEPHONE.—There is evident greater strength to these stocks, and all changes of prices, with few exceptions, are on the ascending scale. American Bell closed the week 4 points better than the previous quotation, and American Telegraph & Cable closed with a slight advance. Erie Telephone is 2 points higher, and Western Union shows a net increase of 1⅜ points. The range of prices for Western Union for the week was between 90⅛, the highest point, and 87¾, the lowest, the closing price being 88⅝; 16,979 shares of Western Union stock changed hands during the week.

ELECTRIC TRACTIONS.—Business was weak in traction securities, and prices in many cases closed fractionally lower. The market was inactive, and the changes in quotations, where they are recorded, are slight.

	Par.	Bid.	Asked.
ELECTRICAL STOCKS.			
Chicago Edison Company	100	126	..
Edison Electric Ill., New York	100	123½	125
Edison Electric Ill., Brooklyn	100	..	110
Edison Electric Ill., Boston	100	147	148
Edison Electric Ill , Philadelphia	100	..	
Edison Ore Milling	100	7½	10
Electric Storage Co., Philadelphia	100	28½	29
Electric Storage, pref	100	31½	32
General Electric	100	34	34⅛
General Electric, pref.	100	82	85
Westinghouse Consolidated, com	50	21½	22½
Westinghouse Consolidated, pref	50	51⅛	52½
BONDS			
Edison Electric Ill., New York, con. 5s	105	109½	..
Edison Electric Light of Europe	100	75	85
General Electric Co., deb. 5s	100	100½	..
TELEGRAPH AND TELEPHONE.			
American Bell Telephone	100	260	262
American District Telegraph	100	..	30
American Telegraph and Cable	100	..	92
Central and South American Telegraph	100	124	127
Commercial Cables	100	175	..
Erie Telephone	100	71	..
New England Telephone	100	..	130
Postal Telegraph Cable	100	99	101
Western Union Telegraph	100	88⅝	88⅞
ELECTRIC TRACTION STOCKS.			
Baltimore Traction	25	18¾	19
Brooklyn Rapid Transit	..	33½	34
Brooklyn Traction	100	..	14
Brooklyn Traction pref	100	46	48
Buffalo Street Railway	100	75	77
Cleveland Electric Railway	100	..	..
Columbus Street Railway	100	46	48
Hestonville	100	47¾	48¼
Hestonville, pref	..	..	62½
New Orleans Traction	100	5	7
New Orleans Traction, pref	100	..	25
North Shore Traction	100	..	20
North Shore Traction, pref	100	..	80
Rochester Street Railway	..	17	19
Steinway Railway	..	45	50
Union Railway (Huckleberry)	..	110	..
Union Traction, rcts $10 pd	..	12¾	13
West End, Boston	100	94	94½
West End, Boston, pref	100	100	..
Worcester Traction	100	16	18
Worcester Traction, pref	100	90	93
BONDS.			
Brooklyn Rapid Transit 5s, 1945	100	90	..
*Buffalo Street Railway 1st con. 5s	100	109	111
Cleveland Electric Railway 1st mtge., 5s	100	102	104
*Columbus Street Railway 1st 5s	100	95	97
Rochester Street Railway 1st 5s	100	90	..
Union Railway (Huckleberry) 1st mtge. 5s	.	107	111
*Westchester Electric 1st mtge. 5s	100	100	103

*With accrued interest.

Special Correspondence.

NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
253 Broadway, NEW YORK, October 28, 1897.

MR. S. F. B. MORSE, of Chicago, was in New York during the week on business, and will return to the Windy City on Saturday. Mr. Morse is agent in Chicago for several different Eastern manufacturers.

ELECTRIC POWER ON THE THIRD AVENUE LINE.—It is reported that the Third Avenue Railroad Company is contemplating the introduction of an underground electric system of propulsion on its Third Avenue line, which is now operated by cable power.

A SUIT has been entered in the United States Circuit Court for the Southern District of New York by the Standard Underground Cable Company, Pittsburg, Pa., against the National Conduit & Cable Company, New York, for infringement of a number of the former's patents on cables, terminals, T-joints, etc. Five patents are involved. At the office of the National Conduit & Cable Company it is stated that no notice of such a suit has been received there.

MR. W. D. PACKARD, secretary and treasurer of the New York & Ohio Company, Warren, Ohio, has been in New York for several days. He has arranged with the firm of Schiff, Jordan & Co. to act as agents in this vicinity for the Packard lamp. Messrs. Schiff, Jordan & Co. will carry a supply of lamps and sell from stock.

THE CHAPIN-DOUGLAS ELECTRIC COMPANY, 136 Liberty Street, has applied to the Supreme Court for the voluntary dissolution of the company. Mr. James J. Grady was appointed referee. The company has no liabilities. Its assets are $5,100, represented by a note. This company was incorporated in December, 1895, with a capital of $10,000. It was consolidated last May into the Columbia Electrical Supply Company.

MR. ELMER P. MORRIS was reported to have been one of the passengers on the Buffalo and New York Express which was wrecked last Sunday morning on the Hudson River Railway. This was untrue, however. Mr. Morris' "miraculous escape" was due to the fact that he returned from the Niagara Falls convention over the Erie Railway, twenty-four hours earlier. The report, however, caused considerable anxiety among his many friends, and he was kept busy for a day or two answering telegrams and telephone calls inquiring for particulars. Mr. Morris says that is the biggest advertisement he ever had in his life.

THE POLICE TELEGRAPH BUREAU IN BROOKLYN.—In his annual report to the Superintendent of Police, Mr. Frank C. Mason, Superintendent of Police Telegraphs, gives some interesting facts. Mr. Mason's department uses 440 sets of telephones, which it rents from the New York & New Jersey Telephone Company, at $10 each per year, and ten central office stations. There are now in operation in the City of Brooklyn 353 police patrol signal boxes, and this system, Mr. Mason reports, is giving the best of satisfaction in every precinct in which it has been installed. The total length of wire in underground conduits in the city is now 37,250 feet, and the total length of wires in cables strung from elevated railroad structures is 71,050 feet.

ELECTION RETURNS will be announced on election night by the New York *World*, by electrical searchlights to distant points of Greater New York. The *World* has contracted with the Rushmore Dynamo Works, Jersey City, to provide the necessary apparatus. One large projector will be mounted on the dome of the *World* Building; one will be placed in the tower of the Ebling Brewery, on 136th Street, and another will be located in the high tower at Fort George, at the upper end of Manhattan Island. In addition to these there will be a number of high-power projectors on the tall Rushmore factory on the Jersey City water front, whose beams will be so distributed as to cover every corner of Greater New York. It is stated that the signals from these projectors will be easily read for over 30 miles around. Rushmore projectors were used with great success in last year's election, and this class of illumination has become quite a feature of the company's business.

NEW ENGLAND NOTES.

BOSTON, Mass., Oct. 26, 1897.

MR. A. D. ADAMS, inventor and manufacturer of the Adams motors and dynamos, has removed his office from 620 Atlantic Avenue to the Tremont Building, Boston.

IN MEMORIAM.—The New England Electrical Trades Association, Boston, at a recent meeting of its executive committee, passed appropriate resolutions in memory of Mr. Charles A. White, of the Bibber-White Company, recently deceased.

THE CROWN WOVEN WIRE BRUSH COMPANY, Salem, Mass., reports a large and increasing demand for its Crown "K" brush. This brush is similar to the imported brush, and as it is offered at 20 per cent. less cost it is rapidly taking the place of the German brush in the United States.

MR. H. C. SPAULDING, Boston, represented the Siemens & Halske Electric Company at the recent Niagara Falls Convention of the American Street Railway Association. Mr. Spaulding succeeded in creating much interest among the members and others present in the dynamos and other manufactures of his company.

THE ANCHOR ELECTRIC COMPANY, Boston, has for quite a while been doing a nice business with central stations. It has recently sold full lines of equipment to three new central stations. The business of this company is really reaching enormous proportions, which is not at all astonishing, considering the tireless energies of its executive and its traveling representatives. They are all wide-awake, active men.

THE O. C. WHITE COMPANY, Worcester, has added a new line of desk fixtures and portables to its list of adjustable fixtures, and the prospects for a ready market in this new departure seem to be very bright. This company is doing a good business just now, and is in receipt of some large and flattering orders, as well as several good-sized repeat orders. Mr. White intends to arrange for the manufacture of this company's well-known adjustable electric fixtures in Canada, so that the growing business of the company in this direction may be promptly attended to.

THE AMERICAN ELECTRIC HEATING CORPORATION, Boston, has recently sold through its Philadelphia agents, Messrs. Mayer & Englund, heaters for seventy cars for the Capital Traction Company, Washington, D. C., and for thirty-five cars for the Chester Traction Company, Chester, Pa. There was considerable competition for these contracts, and the American Electric Heating Corporation has good reason to feel gratified over its victory. The car-heating department of this company is quite busy. General Manager Ayer has himself been on the road, which, in a large measure, accounts for the present active business in all the company's specialties. Mr. Ayer returned a few days ago from a trip to New York, Philadelphia and Washington.

Pittsburg Notes.

Pittsburg, Pa., October 25, 1897.

HOME TELEPHONE ORDINANCE STILL IN DOUBT.—The ordinance granting rights of way to the Home Telephone Company in Allegheny, which was laid on the table for thirty days by Select Council last month, was taken up once more last week, but action was postponed for thirty days longer.

MUNSON BELTS TO BE MADE IN ALLEGHENY.—It is reported that the Charles Munson Belting Company is making preparations for the removal of a large portion of its establishment from Chicago to Allegheny. A large piece of property on River Avenue, adjoining the Groetzinger tannery, has been secured for this purpose. It has been the practice of the Munson Company to ship hides from Chicago to Allegheny for tanning and to have them returned to Chicago after undergoing this process. The establishment of the new factory in Allegheny will render unnecessary this reshipment, and will save a large amount of handling. The new arrangement will doubtless enable the company to effect a considerable economy in the conduct of its business, and will add a new manufacturing industry to the many already located in Allegheny.

CONSOLIDATED TRACTION COMPANY MAKING MORE IMPROVEMENTS.—The foundations of the new car barn which is being built by the Consolidated Traction Company, at the corner of Frankstown and Homeward Avenues, are nearly completed, and show that the building, when finished, will have storage capacity for a very large number of street cars. Work on the reconstruction of the company's road bed in Wilkinsburg is being pushed vigorously, and will be completed before January 1. In regard to the continued complaints of crowded cars during the busy hours, President C. L. Magee states that it will not be possible to put on more cars prior to the completion of the new power house, some time next spring. The present power houses are taxed to their utmost capacity, and it will not be possible to operate the system with its full quota of cars until the new power house is finished and in running order.

Chicago Notes.

Branch Office of The Electrical World,
936 Monadnock Building,
Chicago, Ill., Oct. 26, 1897.

MR. A. McNAB LITTLE has accepted a position as traveling salesman for the Western Electric Company.

MR. E. WARD WILKINS, of the Partrick & Carter Company, Philadelphia, visited Chicago last week en route from a successful Western trip. He reports a decided improvement in business throughout the Far West, and went home rejoicing with a large amount of good business.

THE STOCK OF THE LATE METROPOLITAN ELECTRIC COMPANY, of this city, has been purchased by Mr. John McKinlock, together with the property and good will of the defunct concern. Messrs. William H. McKinlock and W. C. Camp will act as agents for the disposal of the stock, and will take other business in the general electric line as carried on heretofore by the Metropolitan Electric Company.

MR. GEORGE W. PATTERSON, of this city, agent for the Fiberite Company, and the Gordon-Burnham Primary Battery Company, has issued a little card which is quite instructive to business men. It contains a chart which shows at a glance the recurrence of three important industrial periods since the year 1816. It represents the different years when panics started; the years of good times, high prices, etc., and the years of hard times and low prices. The chart shows that panics occur in cycles of 16, 18 and 20 years; good times come every 8, 9 and 10 years, and hard times, 9, 7 and 11 years. Following these laws, it is evident that the year 1897 is the best time to buy standard, reliable electrical material, and that the year 1899 will see the return of good times and high prices. Mr. Patterson ought to succeed in convincing dealers of these important facts with this little chart, which is printed on the back of his business card.

A VISIT TO THE WESTERN ELECTRIC COMPANY'S FACTORY, in this city, just now reveals a strange condition of things, but when a little thought is given to the matter, the mystery is at once dispelled. There is no difficulty in keeping cool at this time of the year, but the Western Electric Company is already at work preparing to keep the people cool next summer, and is therefore engaged in manufacturing fan motors for desks, ceilings and walls, or wherever it may be desired to place them. The company is compelled to make an early start in the work of manufacturing next year's motors in order to be better able to meet the demand for them, which will probably be very large if the past season's business is any criterion. The company had difficulty during the past season to fill the orders for these machines, and in order to avoid any disappointment to its customers next year, it is wisely taking time by the forelock and producing a stock ahead of time.

St. Louis Notes.

St. Louis, Mo., October 26, 1897.

THE EXTENSION OF THE CONDUIT DISTRICT in this city is contemplated, and a bill has been introduced into the City Council for the purpose.

THE ST. LOUIS & SUBURBAN RAILWAY COMPANY has refused to accept its new franchises under the terms prescribed by the Council. The company will introduce new measures to the same effect, because of a large number of amendments made to its original request.

THE CITIZENS' ELECTRIC LIGHT & POWER COMPANY, of East St. Louis, started up on Monday, October 25, with a vastly increased power. An addition twice as large as the original building has been erected, and engines with four times the capacity of the former have been placed in position.

THE BELL TELEPHONE COMPANY received its last permit for conduit work last week; the Kinloch Company completed its conduits some time ago. All the conduits will soon be in place, except those of the telegraph companies, which have made no move as yet to place their wires under ground.

Pacific Coast Notes.

San Francisco, Cal., Oct. 21, 1897.

TRACK WELDING.—The Market Street Railway Company, San Francisco, has commenced welding the tracks of its Folsom Street line. It is probable that lines on Twenty-sixth and other streets will be treated by the same process. The welding of the Twenty-second Street tracks was a success.

THE VACAVILLE (CAL.) WATER & LIGHT COMPANY has closed contracts with the General Electric Company for two 30-kw direct-current generators; with Chas. C. Moore & Co., San Francisco, for an 80-hp McIntosh & Seymour engine, one Babcock & Wilcox boiler, and one of Hoppe's Live Steam Purifiers.

ELECTRIC LIGHT ON YUKON STEAMERS.—Electric lighting plants will be installed on three powerful stern-wheel steamers, for which H. Liebes & Co., of San Francisco, recently let contracts. The fleet of steamers and six barges will be ready to start up the Yukon River next June. The company will expend $300,000 on vessels, wharves, etc., for the Alaska trade.

WORK is well advanced on the power-house annex of the new Claus Spreckels Building. The California Electrical Works has taken the wiring contract for about 800 lights, iron-armored conduit being called for throughout. The steam plant has been set up and will be tested next week. It must be ready for use by November 1. The contract for the motors to be operated by this plant was awarded to the Westinghouse Electric & Manufacturing Company. There will be two 50-hp, two 20-hp and seven 10-hp slow-speed motors belted directly to printing presses used by the *Daily Call*.

A SERIES ARC-LIGHTING PLANT is being installed at the power house in Golden Gate Park, San Francisco. It is practically a duplicate of the installation supplied by the Fort Wayne Electric Corporation for Girard University. There are two Fort Wayne special 40-light generators directly connected with vertical compound engines, built by the Dow Steam Pump Works, San Francisco. The cylinders are high-pressure 7 inches, low-pressure 13 inches, with a stroke of 7 inches. The engines will develop about 35 horse-power at 400 revolutions per minute. The wires will be placed under ground.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has obtained, through its Pacific Coast district agency, the contract for the generating and distributing apparatus for the new water-power electric system of the San Gabriel Electric Company, which will transmit current to Los Angeles, Cal. There will be four 300-kw two-phase generators. The Scott system of "two-phase, three-phase" transmission will be employed. The final distribution in Los Angeles will be two-phase. A 250-kw rotary transformer will supply 500-volt current for street railway and power purposes, and two 250-kw rotaries will furnish current for the 220-volt service. This company, in which Mr. C. A. Balch is interested, has already spent $80,000 or more, in hydraulic work, and the contracts require current to be delivered in Los Angeles February 1, 1898.

ENGLISH NOTES.

(From Our Own Correspondent.)

LONDON, October 18, 1897.

THE CITY & WATERLOO STATION RAILWAY.—It is confidently expected that the electric underground tunnel railway running from Waterloo Station under the river to the Mansion House will be opened for traffic early in January next.

ABSTRACTS OF ENGLISH PATENT SPECIFICATIONS.—Your readers who contemplate taking out English patents may be interested to know that for some time the Comptroller General of Patents has issued a series of volumes containing classified abridgments of English specifications. The series dealing with the period between 1884 and 1888 is now completed, and will very soon be followed by a similar series covering the periods between 1889 and 1892 and 1893 and 1896. Each volume deals with one special subject and gives a précis of the specifications and a copy of the principal drawing or drawings. As these volumes are issued at about a quarter of a dollar in this country, and may be consulted freely at most of the libraries, the convenience of them cannot be overestimated.

THE BOARD OF TRADE ELECTRICAL STANDARDIZING LABORATORY.—Although the Electrical Standardizing Laboratory of the Board of Trade has now been in existence five or six years, it has done, publicly at least, very little work beyond constructing and preserving the three fundamental electrical standards. The laboratory is very well equipped, and a circular has now been issued announcing its readiness to test and certificate electrical measuring instruments, not being meters intended to measure the energy supplied by electric lighting or similar companies; that is to say, it is only prepared to undertake to standardize scientific instruments. The charges are, on the whole, of an exceedingly modest character, and lower than the corresponding charges of other bodies. For instance, 5s. is the fee charged for testing the E. M. F. of a Clark cell at one temperature, and 10s. is the fee for testing to the utmost degree of accuracy the resistance of a standard resistance coil.

THE VENTILATION OF THE UNDERGROUND RAILWAY TUNNELS IN LONDON.—The committee appointed by the Board of Trade in February last, consisting of Sir F. Marinden (chairman), Earl Russell, Sir Douglas Galton, Sir C. Scotter and Dr. J. S. Haldane, have recently issued their report dealing with their inquiry into the system of ventilation of the tunnels of the underground railway. The object of the committee was to inquire into the existing system of ventilation and to ascertain whether any, and if so, what steps could be taken to improve the decidedly imperfect ventilation. It was originally intended to run hot-water locomotives on this railway, but this type of engine not proving satisfactory, coke-burning, and afterward, coal-burning, locomotives were adopted, with the result that the inadequate ventilation of the tunnels left their interior filled with an atmosphere that threatens to asphyxiate all who venture through them. The recommendations of the committee are decidedly drastic. They practically amount to this: That as a temporary measure the Metropolitan Railway shall be permitted to construct additional openings for ventilators, but that these shall be only temporary, and that if at the end of three years electric traction has not been adopted on the railway or some other satisfactory system of artificial ventilation been introduced, it shall be made incumbent upon the company to close the openings if called upon by Parliament to do so. The committee is of the opinion that by far the most satisfactory mode of dealing with the ventilation of these tunnels would be by the adoption of electric traction, and it considers that in view of the probable adoption of electric traction in the near future it can hardly be expected that the company should incur the heavy expense of at once providing fan ventilators.

BRADFORD NEW ELECTRIC SUPPLY STATION.—The new electric supply station of the Bradford Corporation was formally opened last Friday by the mayor. This station, which is to supplement rather than supplant the old station, has become necessary owing to the rapid extension of the system, partly through the success of the electric lighting and partly through the great number of electric motors which have been rented from the corporation. There is at present a motor load of no less than 642 horse-power. The system of supply at Bradford is the continuous-current three-wire system, with 230 volts between each section. The equipment of the new station comprises at present four direct-coupled generating sets, the engines of which are of the Willans type, the dynamos having been built by Messrs. Siemens, Brothers & Co. Two of the sets are 600-hp Willans automatic-expansion, three-crank, triple-expansion engines, direct-coupled to six-pole Siemens dynamos, with drum-wound armatures, the armature connections being interconnected for two pairs of brushes. These dynamos develop 750 amperes at 500 volts, and are placed on the outer mains. The other two sets are 300-hp Willans throttle-expansion engines, direct-coupled to Siemens' two-pole dynamos, with drum armatures. In the boiler house something akin to naval practice has been adopted, the boilers being worked under a forced induced draught of no less than 4 inches to 5 inches of water. The boilers, two in number, are marine multi-tubular boilers, built by Messrs. John Brown & Co., of Sheffield, and fitted with the Ellis & Eaves system of induced fans draught. Each boiler normally develops 600 horse-power under a draught of 4 inches, but can readily be forced up to 800 horse-power. All the pumps, fans, etc., for the boilers are driven by electric motors, as also are the air pump and circulating pump for the surface-condensing plant. The estimated cost of the new electric supply station is about $200,000, of which the building cost $58,000. The city electrical engineer at Bradford is Mr. A. H. Gibbings, who has been prominently associated with the schemes for the introduction of 200-volt lamps, of the free supply of lamps to the consumers and of the penny-in-the-slot electric-meter system.

THE GLASGOW TELEPHONE INQUIRY.—After a hearing extending over eleven days the inquiry into the grievances of the Glasgow telephone subscribers has come to an end, and the president will now report to the Postmaster General. Several things are now quite evident. It is obvious that the refusal of the Glasgow Municipality to grant the telephone company permission to pull up the streets for the purpose of laying telephone ducts is obstruction pure and simple. The contention of the corporation that if it does this the control of the streets of Glasgow will pass out of its hands is a mere quibble (indeed the president of the court said as much), in view of the fact that the telephone company is prepared to let the corporation do the work itself, and to submit to any reasonable conditions the corporation may think fit to impose. It is also obvious that the corporation is being entirely misled by its expert, Mr. A. R. Bennett, as to the probable cost and remunerative character of a telephone exchange. Further it is clear that the average charge in Glasgow (£10) is lower rather than higher than the charges on the Continent, even the charges at the much-quoted Stockholm, when unconsidered trifles are added to them, equal those at Glasgow. On the other hand, there can be no denying that there exists well-grounded and widespread dissatisfaction with the telephone service in Glasgow. The position taken up by the National Telephone Company that the existing service is as good as a single-wire service can be, is probably a strong one, and its contention that there is no remedy but metallic circuits is impregnable, but the deductions which the company draws from these premises that the complaints are mostly frivolous, and that the corporation has made itself solely responsible for the bad service by its refusal to give the company permission to go underground are by no means indisputable. A metallic overhead service would probably be a vast improvement upon the present single-wire system, and the company has considerably lessened the weight which can be attached to the metallic-circuit argument, inasmuch as a few years ago the same officials who have just concluded giving their evidence at Glasgow gave diametrically opposite evidence before a joint committee of the two Houses of Parliament which had been appointed to inquire into the clauses which ought to be inserted in Electric Tramway bills to protect the telephones from injurious disturbances. The counsel for the tramway promoters argued before the joint committee that the telephones, so long as they were on the single-wire earth-return circuit principle, were not entitled to any protection whatsoever, inasmuch as that method of working was obsolete. It was then the cue of the officials of the National Telephone Company to make out with all the gravity that they could command, and to declare on oath that a single-wire overhead system afforded a satisfactory, commercially useful, cheap and effective telephonic system. Thus has the past risen up and confronted the officials of the National Telephone Company who are to-day arguing that proper telephone service is impossible without underground metallic circuits.

General News.

NEW INCORPORATIONS.

THE MANSFIELD ELECTRIC COMPANY has been incorporated at Mansfield, Pa., with a capital stock of $10,000. The directors are D. H. Pitts, C. R. Ross and A. H. Perkins.

THE PRINCESS BAY RAILROAD COMPANY, Richmond, S. I., N. Y., has been incorporated, with a capital stock of $15,000. The incorporators are Seymour Case, of Tottenville, and others.

THE ELECTRICAL ENGINEERING & SUPPLY COMPANY, Charlotte, N. C., has been incorporated, with a capital stock of $5000, by I. W. Faison, Samuel James Smith and David S. Yates.

THE AMBLER & PLYMOUTH TROLLEY RAILWAY COMPANY, Ambler, Pa., has been organized to build a trolley road from Ambler to Plymouth. John A. Wentz and Warren A. Rahn are interested.

THE FITCHBURG & SUBURBAN STREET RAILWAY COMPANY, Fitchburg, Mass., has been organized, with a capital stock of $50,000. The incorporators are H. L. Pierce, H. Porter Hall, H. C. Garfield and J. L. Keavitt.

THE UNION ELECTRIC CONSTRUCTION COMPANY has been incorporated at Des Moines, Ia., with a capital stock of $5,000,000. The directors are William B. Purvis, Halsey J. Tibbals, B. F. Taylor, John S. Carter and others.

THE WASHINGTON ELECTRICAL & MANUFACTURING COMPANY, Washington, D. C., has been organized to manufacture electrical appliances. Mr. H. P. Hill, of Washington, is president of the new company. Capital stock, $10,000.

THE SHENANDOAH STREET RAILWAY COMPANY, Shenandoah, Pa., has been formed to build an electric railway. Those interested are Hamilton Godfrey, Reading; J. W. Johnson, Shenandoah; H. D. Richardson, Ringtown; J. H. Rothermel and H. C. Gupler, Reading. The capital stock of the new company is $100,000.

THE TELEGRAPH AND TELEPHONE.

COLD BROOK, ILL.—A new telephone line will be built between Cold Brook and Cameron.

PAINESVILLE, OHIO.—The Painesville Telephone Company has declared a dividend of 5 per cent.

FORT SCOTT, KAN.—The Kansas & Missouri Telephone Company will build new lines from Fort Scott to Wichita, Kan.

NOBLESVILLE, IND.—The Noblesville Telephone Company will extend its system to Tipton, Cicero, Arcadia, Atlanta and Sheridan, Ind.

HYATTSVILLE, MD.—W. C. Lord and C. L. Lanham have formed a company to build and operate a telephone system in Prince George's County.

FARMINGTON, ILL.—The Fulton County Telephone Company will extend its line to Bushnell, a permit to enter the city having been granted the company by the City Council.

MONTGOMERY CITY, MO.—The telephone company of this place was organized by the election of a board of trustees and officers, with Dorsey Mudd as general manager, and Foster Mudd, president.

CLEVELAND, OHIO.—The Mutual Telephone Company, of this city, has ordered a new switchboard. Its present facilities are inadequate to meet the demand for its service. The company now has nearly 900 instruments in operation.

ST. JOSEPH, MICH.—The Michigan Telephone Company has had serious trouble with the City Councils in this place and at Benton Harbor, and has asked the court for an injunction restraining the officials from removing poles or arresting its men.

NOBLESVILLE, IND.—The Noblesville Telephone Company has increased its capital stock, and will shortly commence the extension of its lines to many parts of the county, as far north as Tipton. Local service will be put in at Cicero, Arcadia, Atlanta and Sheridan.

VALPARAISO, IND.—The Harrison Telephone Company, of Lafayette, has completed its line to this city. This gives the company connections with sixty-two towns in the State as far south as Indianapolis and Crawfordsville. The officials state that the line will be extended through the northern part of the State.

TACOMA, WASH.—The Sunset Telephone Company has recently completed a new copper metallic circuit from Portland to Tacoma and Seattle. This gives the company two such circuits from Everett to Walla Walla via Portland. The company is also building a new line from Port Townsend to Marrowstone Point.

JANESVILLE, WIS.—The Wisconsin Telephone Company has given notice to its subscribers that on January 1 next its rates will be advanced to $30 and $18 for business and residence instruments, respectively. These rates are being charged by the Northwestern Company. The Wisconsin Company is at the present time charging $24 and $12 for these two services.

TIFFIN, OHIO.—The Tiffin Home Telephone Company, composed of local merchants, has secured the services of an expert engineer to lay out its lines, etc., and work has already begun. It is stated that about 95 per cent. of the citizens favor the new company, and will take its service in place of the Bell Company. It is expected that the new system will be in operation by the first of the year.

RHINELANDER, WIS.—The Wisconsin Valley Telephone Company is interesting the citizens of a number of towns in Northern Wisconsin in a long-distance telephone enterprise. The proposed lines will include Madison, Wausau, Merrill, Rhinelander, Eau Claire, Chippewa Falls, Menominee, Hudson, New Richmond, Cumberland, Shell Lake, Hayward, Ashland, Washburn, Duluth, West Superior, St. Paul, Minneapolis, and all the towns between the above mentioned places.

Electric Light and Power.

BELFAST, ME.—The Belfast Light & Power Company will extend its system.

WORCESTER, MASS.—The Worcester Electric Light Company will enlarge its plant.

ROCKVILLE, IND.—The citizens are making an effort to establish municipal lighting.

PLYMOUTH, PA.—The city is considering the question of erecting its own electric-light plant.

GRAND RAPIDS, MICH.—A municipal electric-lighting plant is to be established at this place.

AYER, MASS.—A movement is being made to have the town put in an electric-lighting plant near the pumping station.

MARTIN'S FERRY, OHIO.—The Laughlin Company will erect a tin plate mill here. An electric-light plant will also be built.

PERTH AMBOY, N. J.—The Perth Amboy Gas Company is considering increasing its business by the addition of an electric plant.

MARSHALLTOWN, IA.—The Glucose Sugar Refining Company will expend $100,000 in improvements. An electric plant will be added.

SALEM, N. Y.—The city is agitating the question of lighting its streets by electricity. Address the Board of Trustees for further information.

GREENWOOD, S. C.—This place has voted in favor of issuing $40,000 in bonds for the construction of an electric-light plant and a water-works system.

NORTH BROOKFIELD, MASS.—The Central Massachusetts Electric Light Company, of Palmer, Mass., will petition the Council of this place for a franchise.

HARRISBURG, PA.—Select Councilman Hummel is urging a plan to build a city electric-lighting plant. It contemplates the issuing of $100,000 worth of bonds.

CLINTON, ILL.—The power house of the Clinton Electric Light & Power Company was destroyed by fire on the night of October 23. All of the machinery was destroyed.

RENO, NEV.—At an election held a few days ago the proposition to bond the city for $140,000 to raise funds for the erection of water works and an electric-light plant was carried by a large majority.

RICHMOND, VA.—The Virginia Electric Company, of Baltimore, the Home Electric Company, and the Southern Electric Company have petitioned the city for permission to engage in the business of manufacturing and furnishing electric power and lighting in the city.

CHICAGO, ILL.—The City Council has voted an appropriation of $150,000 to extend the city's lighting plants, the power to be supplied from the water pumping stations at night. It is thought that this is a step in the direction of municipal ownership of electric-lighting plants in this city.

The Electric Railway.

BOSTON, MASS.—The West End Street Railway Company will extend its lines in Brookline, Mass.

YOUNGSTOWN, OHIO.—An electric railway line from Youngstown to Hubbard, a distance of 7 miles, is projected.

NORTHAMPTON, MASS.—The Northampton Street Railway Company has been granted permission to extend its electric line.

MONTOURSVILLE, PA.—The Montoursville Electric Railway Company is to be extended next spring to Hughesville and Muncy.

IRWIN, PA.—John George, of Irwin, Pa., has secured a charter for an electric railway to be constructed from Irwin to McKeesport.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Company will extend its railway to North Greenfield and Waukesha.

FLINT, MICH.—The company formed to build an electric railway from this place to Pontiac has been granted a franchise by Goodrich, Mich.

DONALDSVILLE, LA.—The Town Council has made arrangements with the local banks for a loan of $16,000 to pay for an electric light plant.

SEDALIA, MO.—Woodford Brooks, of this place, is at the head of a company formed to build an electric railway from Sedalia to McAllister Springs, a distance of 25 miles.

MIDDLETOWN, MD.—Plans have been completed for a new electric power house to be built near this place for the Frederick & Middletown Electric Railroad Company.

BALTIMORE, MD.—A syndicate of Baltimore capitalists has purchased the plant and franchises of the Columbia & Maryland Railway, and will complete the line as an electric railway.

NORTH BROOKFIELD, MASS.—The Warren, Brookfield & Spencer Electric Street Railway Company has been granted a franchise to build a branch line from North Brookfield to East Brookfield.

BUFFALO, N. Y.—An electric railroad will be built from here to Depew. Mr. George A. Ricker, vice-president and chief engineer of the Buffalo & Depew Railroad Company, can give further information on the subject.

YOUNGSTOWN, OHIO.—John E. McVey and A. A. Anderson, of Youngstown, Ohio, will organize a company for the purpose of constructing an electric railway from Youngstown to Struthers. Right of way is being obtained.

ALBANY, N. Y.—The State Railroad Commission has granted the application of the Buffalo & Depew Railway Company and the Liberty & Jeffersonville Electric Railway Company for permission to construct electric roads.

PORT JERVIS, N. Y.—A trolley system will be built in this town. Mr. Waller, superintendent of the Port Jervis, Monticello & New York Railroad, and City Engineer Irving Righter are securing the consent of the property owners.

CHICAGO, ILL.—The Northside Electric Railway Company has secured right of way for a new electric line, 7 miles in length, to be constructed through Dearborn and other streets. The company will now petition the Council for a franchise.

HARRISBURG, PA.—The Second Avenue Electric Railway Company, of this place, will build a line from Boston, Pa., to West Newton. Surveys are also being made for an electric railway to run from West Newton to Greensburg, Madison, Arona and Adamsburg.

BALTIMORE, MD.—The Baltimore, North Point & Bear Creek Railway Company is securing right of way for an electric line to be constructed through Baltimore County. No contracts have been let. Daniel Keller, of Baltimore, is president of the company.

HAMILTON, OHIO.—The Hamilton & Okeana Street Railroad Company, incorporated at Columbus, will run from Hamilton to Scipio. The company has secured the right of way all along the route, and the County Commissioners will shortly be asked to grant the right of way, when work on the new road will immediately commence.

CHATTANOOGA, TENN.—The Chattanooga & Lookout Mountain Railroad Company has just been incorporated for the purpose of operating an electric railway on the top of Lookout Mountain. The line will extend from Point Park to Lula Lake, a distance of 7 miles, and work will be commenced at once. The cost of the road, it is stated, will be about $150,000. At the end of the line a thirty-acre park will be established.

BALTIMORE, MD.—The section of the Baltimore & Northern Railway between Mt. Washington and Baltimore was opened to the public on October 18. The cars run from the corner of Calvert and Baltimore streets to Mt. Washington, and the trip consumes about thirty-five minutes, the distance being about 6½ miles. The line between Mt. Washington and Pikesville is about ready to open, and this, with the portion already opened, will enable passengers to travel from Baltimore to Emory Grove, a distance of 21 miles, without change of cars.

BOUND BROOK, N. J.—A remarkably rapid piece of trolley work construction was carried through in this neighborhood on October 24. The New York & Philadelphia Traction Company has for years been anxious to build a road, about 2½ miles in length, connecting Somerville and Bound Brook. The company has been opposed by the Brunswick Traction Company, of New Brunswick, and has so far been unable to obtain a franchise. On the theory that possession is nine points of the law, the first-named company set in on the night of October 23 with a special train with all the apparatus, tools and supplies for the construction of the line. Ties, poles, rails, wire and a trolley car complete, beside about 1,000 negro laborers, came on the train. A few moments after midnight the turnpike was alight with torches, and the laborers were hard at work putting in the line. No injunction can be served in the State of New Jersey on Sunday, and no force of deputies could be raised sufficiently large to stop the work by force. Several skir-

mishes during the day Sunday took place, but the work was not stopped. Late Sunday night the line was connected with a dynamo, which had been previously set up in private buildings, and the one trolley car was put into service.

TERRE HAUTE, IND.—The Terre Haute Electric Street Railway Company was placed in the hands of a receiver on October 18. The receivership was the result of a levy on the property of the company by City Treasurer Balch for $5000 delinquent taxes. The receivership also applies to the Citizens Electric Light Company, which is owned by the street railway company, and which has a five-year contract to light the city. The city's complaint alleges that the company is insolvent; that it has a first-mortgage indebtedness of $400,000, besides owing the city $5,000 taxes and $10,000 for street improvements. The street railway officials are overwhelmed and crushed by the blow, since, they state, it was entirely unwarranted. The levy upon their property, it is reported, was made at an untimely hour, and no notice was given to the company of the intended action. The action of the mayor in ordering the judgment against the company, it is stated, was not authorized by the City Council; indeed it was unknown to them until it had taken place. It is stated that there never has been a case in Indiana where a receivership was applied for in a tax case, and those well informed do not believe such a step can be taken in the matter of street paving and assessments under any condition. Internal Revenue Collector Jump was appointed receiver of the company, and his bond was placed at $50,000.

PERSONAL NOTES.

MR. WALTER G. BOND has resigned his position as editor of our English contemporary, the London *Electrician*. Mr. Bond has been connected with the *Electrician* since April, 1888, and has been editor since the retirement from that position of Mr. A. P. Trotter, in April, 1895.

MR. GUSTAVE FISCHER, Chief Assistant Engineer for Tramways of Sydney, Australia, is now in the States on a tour of inspection among American electric railways. Mr. Fischer was a very interested attendant at the recent Convention of the American Street Railway Association at Niagara Falls.

MR. W. S. BARTHOLOMEW, of the Adams-Westlake Company, Chicago, escaped unhurt in the recent wreck at Garrison's on the New York Central road, and had the good fortune to secure a number of very fine photographs of scenes about the wreck immediately after its occurrence. Mr. Bartholomew was in no way injured, and, of course, was the recipient of many congratulations.

MR. F. H. STILLMAN, of Watson & Stillman, manufacturers of hydraulic machinery, pumps and presses, New York, was one of the passengers on the ill-fated New York Central train which was wrecked at Garrison's Station a few days ago. Mr. Stillman escaped from the train by swimming, and his only injury was a bruised foot. His many friends are congratulating him on his almost miraculous escape from death.

MR. EDMUND HOWL, of Dudley, England, general manager of the South Staffordshire Mining Drainage Commission, which was appointed by Parliament to inquire into the question of drainage of deep coal mines in Staffordshire and adjoining districts, is in New York for the purpose of making contracts for electrical-pumping machinery to be used in connection with a large system of power distribution for the relief of the flooded mines. Mr. Howl will sail on the "St. Paul" next Wednesday.

Trade and Industrial Notes.

THE SAWYER ELECTRIC COMPANY, of Philadelphia, has moved its offices from the Lippincott Building to the Sawyer Building, 1308 Arch Street. The company occupies the entire building at the latter address. The change was rendered necessary on account of the large increase in the company's business.

REFLECTORS of the patented system of I. P. Frink, 551 Pearl Street, New York City, have been installed in the art galleries of the following named department stores: Abraham & Straus, Brooklyn, N. Y.; Bloomingdale Brothers, and R. H. Macy & Co., New York, and Hahne & Co., Newark, N. J.

"PLATINUM" is the title of a little pamphlet published and just issued by Baker & Co., platinum refiners, Newark, N. J. The pamphlet deals entirely with the subject of sources of supply and identification and separation of platinum ore. It also contains many facts of interest to prospectors and miners. It is very neatly gotten up.

STEAM AND ELECTRICAL HOISTING ENGINES constitute the subject of a catalogue just issued by the C. W. Hunt Company, 45 Broadway, New York. The catalogue is excellently illustrated and shows hoisting engines of various designs and their applications. This company's engines are found in a great many electric power stations for the handling of coal, ashes, etc.

THE DAYLIGHT DESK LAMP, manufactured by the Waring Supply Company, New York City, gives an abundance of soft light, which renders it almost indispensable in dark offices. The light is so well distributed that no shadows are thrown on the desk, and at the same time the eyes are protected. The company reports that this lamp is growing in popular favor and that it is doing well with them.

THE ELECTRIC APPLIANCE COMPANY, Chicago, has recently increased its stock of clay tubes and bushings for electric wiring, and is now prepared to promptly furnish tubes in any size and of any length up to 24 inches, in unlimited quantities. The demand for wiring tubes has increased of late, and the clay tube seems to be in general favor on account of its economy and its power to stand rough handling.

A FULL STOCK OF MICA, both India and amber, will be carried hereafter by Mr. John Child, Monadnock Block, Chicago; the Central Union Brass Company, St. Louis; Reger & Atwater Company, San Francisco, all of whom represent Mr. A. O. Schoonmaker, mica dealer, of New York City. Mr. Schoonmaker has placed these stocks of mica with his agencies in order to better accommodate the Western trade, and orders will be promptly filled from all of these depots.

OVERHAULING STORAGE BATTERIES.—In THE ELECTRICAL WORLD of October 16 appeared an article in reference to the method of J. E. Haschke, of Chicago, of overhauling storage batteries. The battery there specifically referred to was of the New York accumulator type. It should not, however, be confounded with that of the New York Accumulator & Electric Company. There is no connection whatever between the two, and in justice to the latter concern this explanation is made.

THE PURITAN ELECTRIC COMPANY has moved its office from 150 Nassau Street to the Bowling Green Building, 11 Broadway, New York City. In its new quarters the company has increased facilities for handling its alternating-enclosed arc lamp. The change of location was rendered necessary on account of the large increase in business experienced by the company. Since the fall season began this increase has been marked, and it has taxed the productive facilities of the company to the utmost.

GALE'S COMMUTATOR COMPOUND seems to be growing in favor and demand. Messrs. K. McLennan & Co., Chicago, state that the sales of their Compound have increased more than threefold since the first of September. They inform us that their compound is regularly used by every power plant and central station in the United States and Canada, and by a large number of isolated plants. The firm has recently established agencies in Norway, Sweden, England, France, Germany, and will soon open one in Japan.

MR. HUGO DIEMER, of Cincinnati, and Mr. C. R. Hebble, of Xenia, Ohio, have formed a copartnership and gone into business as electrical contractors. The partnership will be known by the name of Diemer & Hebble, with headquarters at 810 Neave Building, Cincinnati. The firm will represent in its territory the Card Electric Company, of Mansfield, Ohio, and the Shelby Electric Company. Both gentlemen are graduates from technical institutions and have had practical business experience. Mr. Diemer was formerly purchasing agent for the Bullock Electric Manufacturing Company.

THE REGULATING SOCKET as now manufactured by the G. F. Brunt Porcelain Works, East Liverpool, Ohio, shows some improvement on the device illustrated in THE ELECTRICAL WORLD, of January 23, 1897. The improvement consists in substituting an ordinary incandescent lamp key for the spur with which the older socket was provided. It was necessary to move this spur up and down through a vertical slot in order to graduate the light, but the key renders the operation much easier and produces the same results by simply turning the key, as in an ordinary lamp. The socket gives 5 degrees of light, ranging from 2 to 16 candle-power. It is adapted for direct or alternating current, and any voltage from 50 to 118. It is stated that it saves current when turned down to the lowest degree. This regulating socket is suitable for the sick room, vestibules, sleeping apartments, etc., where it is desired to keep a low light.

Business Notices.

THE ILLUSTRATIONS in this issue were made by the Photo-Engraving Company, 67-71 Park Place, New York City.

Illustrated Record of Electrical Patents.

UNITED STATES PATENTS ISSUED OCT. 19, 1897.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

591,855. ELECTRODE FOR STORAGE BATTERIES; H. S. Lloyd, Philadelphia, Pa. App. filed March 15, 1897. An electrode, comprising a frame, two or more layers or strips formed of lead or an alloy thereof extending between the side bars of the frame, and a perforated leaden plate situated between such layers.

591,861. ELECTRICAL CURRENT INTERRUPTER; H. W. Mather, Roseville, N. J. App. filed Feb. 17, 1897. A strip or ribbon for an electrical current interrupted stencil, made of paper having a portion of its fibre rendered structureless and forming a hard mass about the remaining fibre.

591,869. ELECTRIC TRANSFORMER; W. S. Moody, Lynn, Mass. App. filed May 20, 1897. In a transformer the combination of a core, primary and secondary windings and insulation for insulating the primary winding from the secondary winding, not applied to said windings direct or either of them, but separated from the windings and permitting a more ready absorption of the heat developed in the windings.

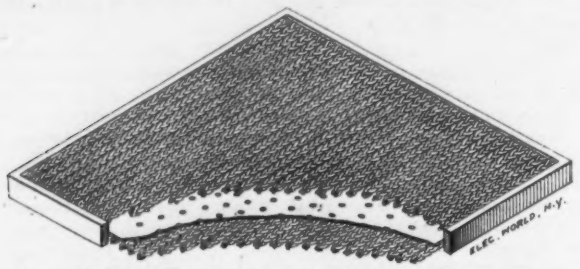
591,879. ELECTRIC CONTROLLER; H. G. Reist, Schenectady, N. Y. App. filed March 9, 1897. In a controller for alternating-current induction motors, the combination of a single switch for opening and closing the primary circuit of the motor and for reversing the motor, and a separate regulating switch in the secondary circuit of the motor.

591,895. ELECTRIC PUSH BUTTON; E. H. Stanley, Lake Geneva, Wisconsin. App. filed Dec. 18, 1896. In an electric push button, the combination, with a shell adapted to be secured directly to the wall and which has recesses in its back, of contact strips secured in the bottoms of said recesses, and a push button for causing the free portions of the said strips to contact.

LIBRARY

591,897. ELECTROMAGNETIC ENGINE; W. Mont Storm, New York, N. Y. App. filed Dec. 8, 1896. In an electromagnetic engine, the combination, with two helices arranged in an electric circuit, a main shaft, and a solenoid or piston guided in the helices and connected with the main shaft, of mercury cups to which the terminals of the helices lead, and means actuated by the main shaft, whereby the circuit is alternately closed in said helices through said mercury cups.

591,898. DAMPER FOR ELECTRIC MEASURING INSTRUMENTS; E. Thomson, Swampscott, Mass. App. filed July 22, 1897. A damping mechanism, consisting of a moving member, a brake piece, and a coil inducing



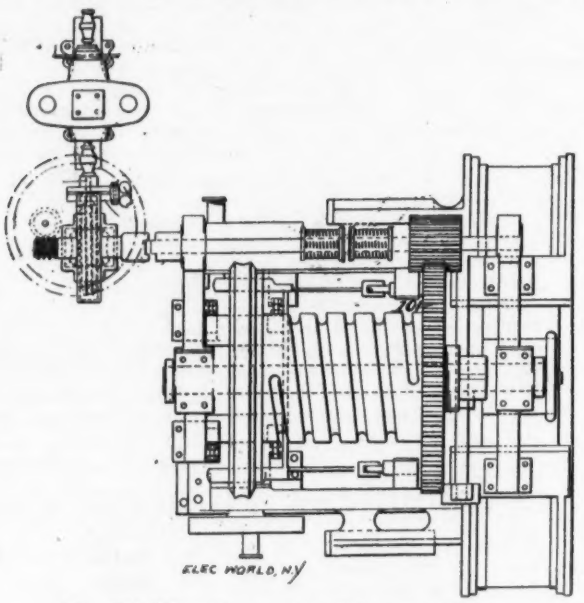
No. 591,855.—Electrode for Storage Batteries.

an alternating magnetic field acting upon the brake piece to alternately apply and release it.

591,899. REGULATING RÖNTGEN RAY TUBES; E. Thomson, Swampscott, Mass. App. filed Aug. 4, 1897. As a new article of manufacture for use with Crookes tubes having an extension containing a volatilizable substance or compound, a separable vacuum adjuster, consisting of an exhausted auxiliary bulb having a portion fitted to the main tube for the transfer of heat thereto, and containing terminals for the passage of electric discharges.

591,917. FUSE BOX; A. W. France, Philadelphia, Pa. App. filed March 30, 1897. A fuse box having an outer casing, an inner casing of non-conductible material, a non-conductible plate with oppositely locked contact points thereon having insulated conductors connected therewith, a block in said inner casing having conducting bolts passing therethrough from opposite sides thereof, springs connected with the ends of said bolts and in contact with said contact points and a fusible conductor passing through said block and connected at its ends with said bolts on opposite sides of the said plug.

591,995. ELECTRICAL STEERING GEAR; J. D. Williamson, Jr., Philadelphia, Pa. App. filed May 15, 1894. In an electric telemotor, the combination of an electric generator, a current transmitter provided with numerous contact points for regulating the extent of movement of the ob-



No. 591,995.—Electrical Steering Gear.

ject to be moved; a combined current receiver and circuit interrupter electrically connected with the contact points on said transmitter and provided with a series of stationary contact points and with a series of movable contact points, one of the latter being a circuit-interrupting contact point connected by a wire with the generator; an electric motor electrically connected with said receiver and interrupter, and means for mechanically operating said interrupter so as to cause its said circuit-interrupting contact point to interrupt the circuit to the moor and simultaneously establish a new circuit with the generator through said wire.

591,997. INSULATED ELECTRIC CONDUCTOR AND APPARATUS FOR MAKING SAME; J. D. Bishop, New York, N. Y. App. filed June 7, 1897. Apparatus for covering a conductor with a continuous tube of flexible insulating material, comprising feed devices for feeding the conductor and a web of insulating material simultaneously to a flaring, former to curl the material about the wire with overlapping edges, means for applying adhesive material to an edge of the flexible material to unite the overlapping edges, and a pressure device to force the overlapping edges to adhere to one another.

592,016. INSULATING COUPLING FOR ELECTRIC WIRE CONDUITS; L. McCarthy, Boston, Mass. App. filed July 2, 1897. An insulating coupling, comprising opposite connections made hollow or tubular for the reception of conducting wires, and an interposed insulator, and having at opposite sides of the insulator lateral passages to permit the said wires to be withdrawn and passed around the exterior of the insulator.

592,025. ELECTRIC-CONDUCTOR WIRE CONNECTOR; I. Shultes, Martin, Mich. App. filed April 2, 1897. A wire connector, consisting of side pieces, a block with grooves in its under face, a plate spanning the space between the grooves, wedge-pieces in the grooves and wires connected thereto.

592,056. ELECTRIC TRACTION; W. Kingsland, Llandudno, England. App. filed March 5, 1897. In electrical traction, the combination with a continuous main electrical conductor, and sectional working conductors from which the motor car directly collects the current, of a number of sectional conductors, one such for every sectional working conductor, and through which auxiliary conductor the current is passed from the main to the sectional working conductor aforesaid, and means whereby each sectional auxiliary conductor can be either connected to or disconnected from the main conductor or from its corresponding sectional working conductor.

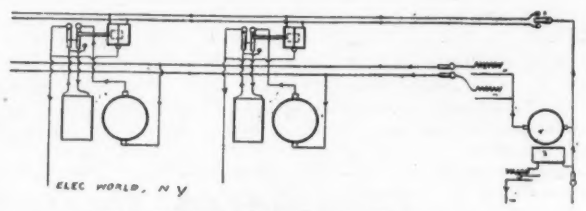
592,100. AUTOMATIC MAGNETIC CIRCUIT BREAKER. W. M. Scott, Philadelphia, Pa. App. filed March 17, 1897. In an automatic magnetic circuit-breaker the combination with a switch and contacts of a spring adapted to actuate the switch, a latch adapted to restrain the switch against the action of the spring, two coils each provided with a movable core, one core adapted to be actuated by a predetermined magnetic flux to rise in the coil, and a pin adapted to communicate the force of the core's movement to the latch to release the switch, the other core adapted to be held within its coil during normal magnetic flux, and to fall upon the occurrence of an interrupted or predetermined subnormal magnetic flux, and a rod attached to the core, a lever adapted to be actuated thereby, and a cam adapted to be actuated by the lever to actuate the latch to release the switch.

592,104. CONTROLLER; T. Von Zweigbergk, Cleveland, Ohio. App. filed April 3, 1897. The combination, with a series-wound electric motor and a controller adapted to entirely open the circuit through the field of the motor, of means for short-circuiting said field just after, but not until after said controller has so opened said circuit.

592,120. COMBINED AUTOMATIC BLOCK AND SIGNAL SYSTEM AND BRAKE AUTOMATIC APPLIANCE; J. G. Pearce, Oakland, Cal. App. filed April 3, 1893. A combined automatic block and brake automatic appliance comprising a series of depression levers situated near the station, with electrical wires connected therewith, an indicator at the station from which the train is departing, so connected with a lever that its depression by the passing train operates an adjacent signal and returns the first-named signal to "safety," a second lever succeeding the first one and electrically connected with signals at the succeeding station whereby the depression of the second lever indicates the approach of the train with the section, a series of check levers and electrical connections situated in groups between the stations for operating the train mechanism, a third lever at the departure station, with electrical connections through the groups of levers, whereby the depression of said third lever by the passing train sets the mechanism of the groups throughout the section in condition to check progress of an opposing train.

592,123. ELECTRIC SWITCHBOARD; G. W. Ribble, Hyattsville, Md. App. filed Aug. 19, 1897. In an electric switchboard or other like structure, a terminal or circuit-closing part formed with a depression or recess having undercut or overhanging sides, and a marking disc or plate fitting in said depression or recess, engaging beneath the sides and removably held thereby.

592,150. TRAVELING-CONTACT DEVICE; E. Lundquist, Pittsburg, Pa. App. filed Oct. 28, 1896. In a traveling-contact device, in combination



No. 592,225.—Electrical Railway.

with a conductor, a wheel, having recesses concentric with the axle of the wheel; an elastic continuous ring, of suitable electric conducting material on said wheel and supported by the walls of said recesses; means for pressing said wheel against said conductor, whereby when the wheel is forced against the conductor that part of the ring so pressed will be forced toward the centre of the wheel, while the remaining part of the ring is conformed to the said recesses.

592,225. ELECTRIC RAILWAY; R. M. Hunter, Philadelphia, Pa. App. filed June 12, 1897. In an electric railway car, the combination of a series of electrically independent longitudinal conductors terminating in suitable couplings at each end of the car, an electric motor on the car, having one terminal of its field magnets and armature electrically connected with a portion of said longitudinal conductors, and switch devices interposed between the motor and said longitudinal conductors for connecting at least one of the elements (the field-magnets and armature) with either of the series of said longitudinal conductors.